CHAIN O' LAKES WATER QUALITY

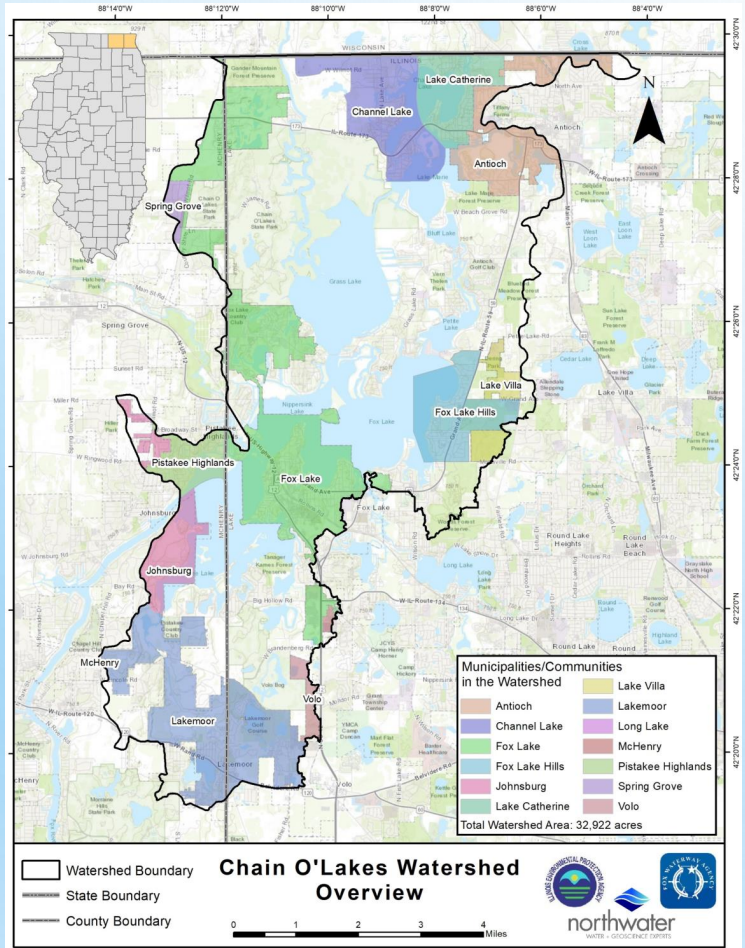
NUTRIENTS: TOO MUCH OF A GOOD THING

TED KRATSCHMER, NORTHWATER CONSULTING

MARCH 16, 2023

northwater
WATER + GEOSCIENCE EXPERTS

WATER QUALITY ISSUES IN THE CHAIN O' LAKES



- BACKGROUND ON WATER QUALITY – NUTRIENTS
  - HOW WE TALK ABOUT IT AND THINK ABOUT IT
  - ROLE OF SEDIMENTS
- QUICK DISCUSSION OF INDIVIDUAL LAKE WATER QUALITY
- PRELIMINARY TRENDS IN NUTRIENTS TO AND FROM CHAIN
- HOW DO WE FIX THIS? HOW CAN YOU HELP?
  - BEST MANAGEMENT PRACTICES

WATERSHED PLAN GOALS

- OUR WATER IS CLEAR ENOUGH THAT YOU CAN SEE THE BOTTOM IN SHALLOW WATER
- OUR WATER IS FREE OF EXCESSIVE NUTRIENTS SO ALGAE GROWTH DOES NOT TURN OUR WATER GREEN.
- OUR WATER IS CLEAN ENOUGH THAT THERE ARE NO RECREATIONAL RESTRICTIONS FOR BOATING, SWIMMING AND FISHING
- OUR COMMUNITY AND STAKEHOLDER ARE KNOWLEDGEABLE AND ENGAGED IN THE PRESERVATION OF OUR WATERSHED

WATER QUALITY ISSUES IN THE CHAIN O' LAKES

SEDIMENTATION

EROSION

ALGAE BLOOMS

TOO MANY AQUATIC PLANTS

LOW DISSOLVED OXYGEN

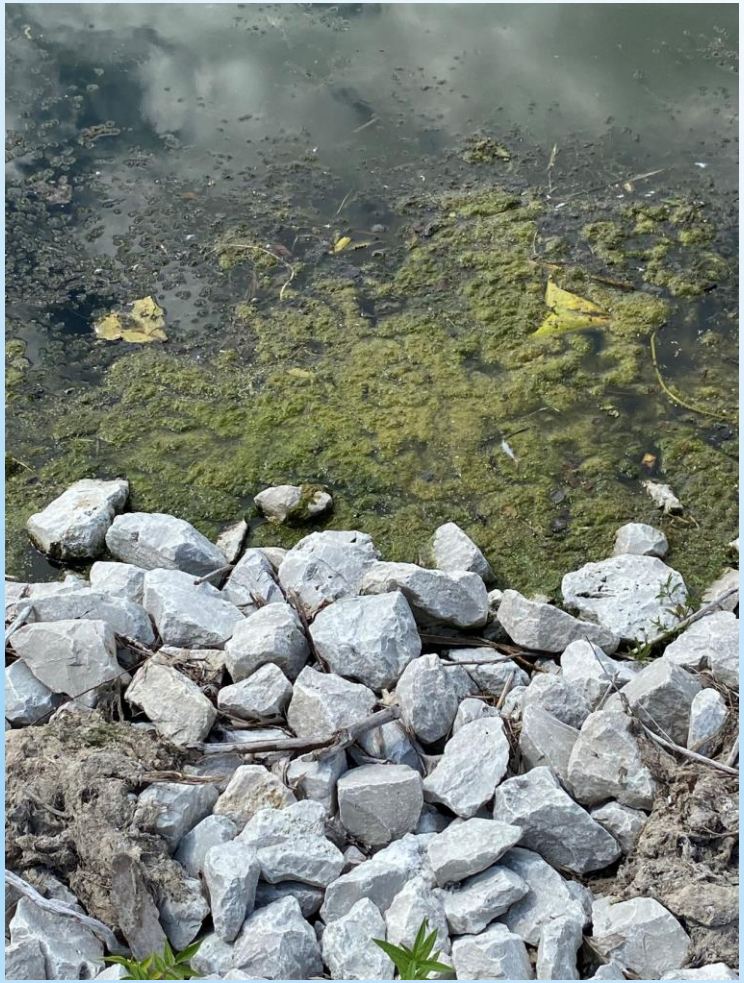
E. COLI

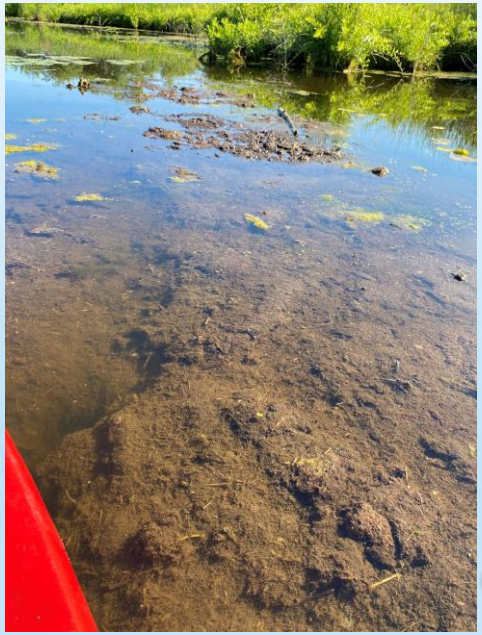
- NUTRIENTS!

NUTRIENT ENRICHMENT: HOW WE TALK ABOUT IT

- HIGHLY NUTRIENT ENRICHED SYSTEMS ARE TERMED **"EUTROPHIC"**
  - THE CHAIN O' LAKES ARE EUTROPHIC
  - TYPICALLY, A LAKE BECOMES EUTROPHIC AS IT AGES
  - IN A NATURAL SYSTEM, CAN TAKE HUNDREDS OR THOUSANDS OF YEARS
  - IN A HUMAN-AFFECTED SYSTEM, EUTROPHICATION IS ACCELERATED
- SOMEWHAT ENRICHED LAKES ARE CALLED "MESOTROPHIC"
- NUTRIENT POOR LAKES ARE CALLED "OLIGOTROPHIC"

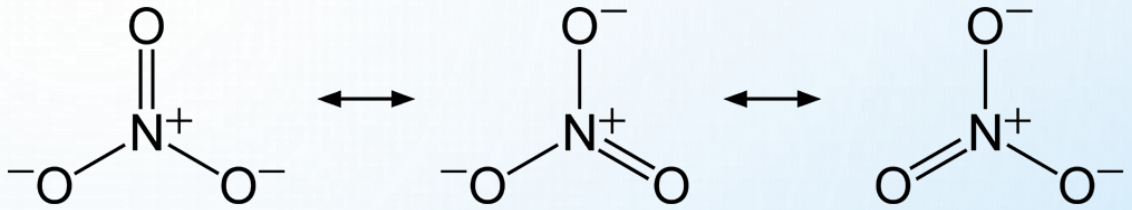
- ALGAL BLOOMS
  - INCLUDING BLUE GREEN ALGAE THAT MAY BE TOXIC
- EXCESS AQUATIC PLANTS
- MURKY, “DIRTY” WATER
- SEDIMENTATION
- POOR FISH HABITAT

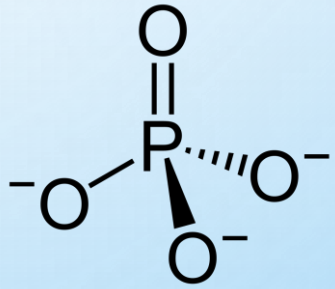




WATER QUALITY: NUTRIENT ENRICHMENT

THE TWO MAJOR NUTRIENTS THAT ARE IMPORTANT IN WATER QUALITY ARE NITROGEN AND PHOSPHORUS





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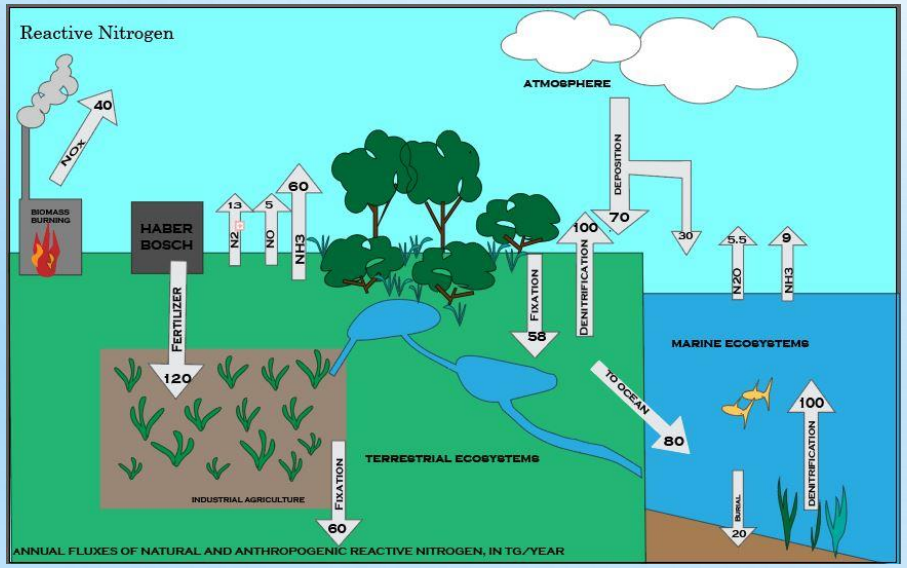
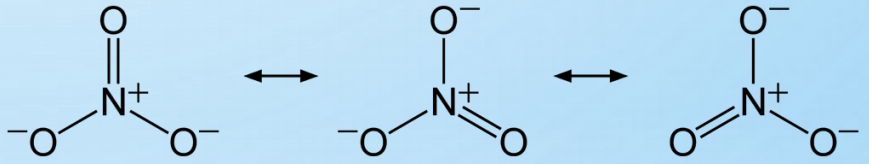


- NITROGEN (N)
  - MAJOR FORMS RELEVANT TO WATER:
    - NITRATE, AMMONIA, ORGANIC NITROGEN … TOTAL N
    - NO_3^- NH_3 *TOTAL KJELDAHL NITROGEN*
    - SOURCES:
      - NITROGEN FIXATION BY BACTERIA, INDUSTRIAL/AG, ATMOSPHERIC DEPOSITION
      - IN OUR LAKES: RAINWATER RUNOFF
    - N IS GENERALLY ABUNDANT IN LAKES
    - N IS RELEASED TO ATMOSPHERE AS N_2



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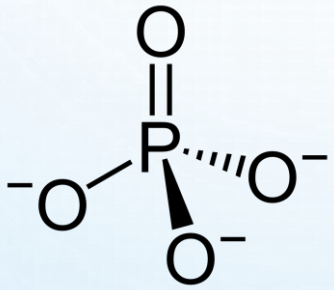
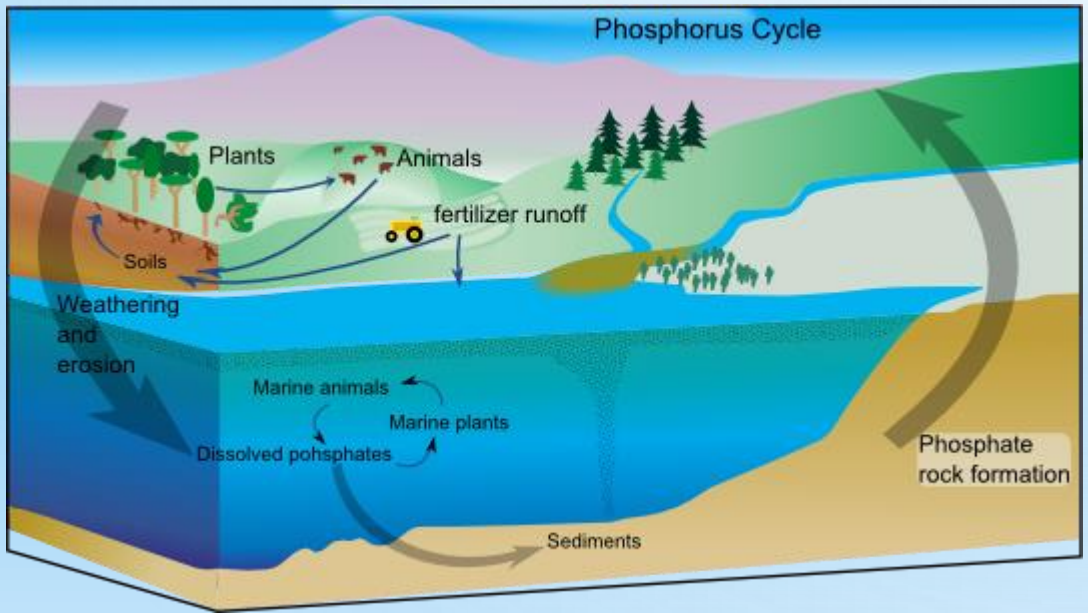
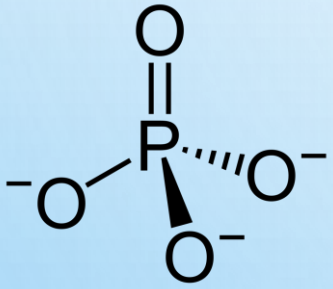




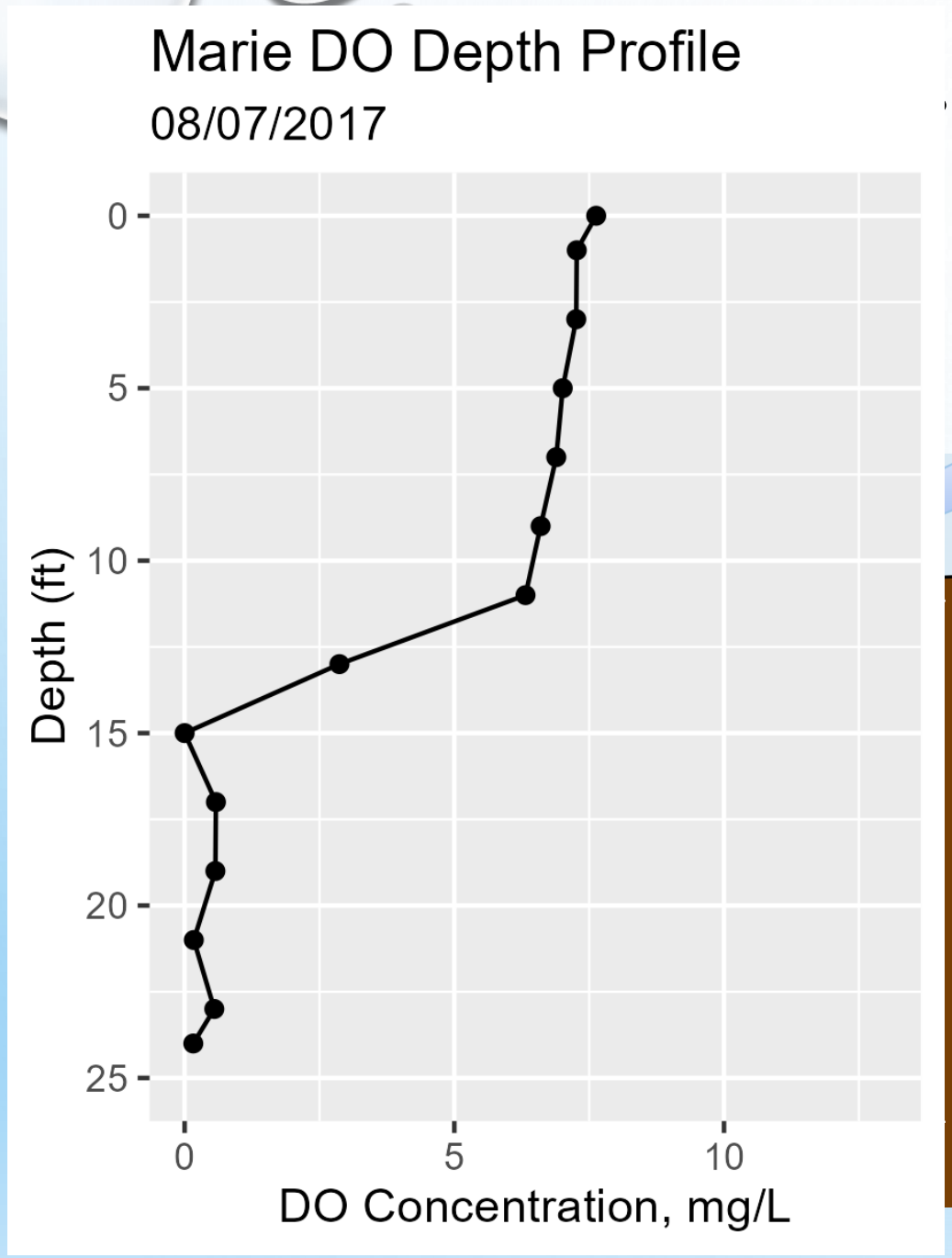
- PHOSPHORUS (P)
  - MAJOR FORMS RELEVANT TO WATER:
    - PARTICULATE P, DISSOLVED P
    - PARTICULATE IS INCORPORATED INTO PLANT AND ANIMAL MATTER, BOUND TO SEDIMENTS
    - DISSOLVED IS USUALLY QUICKLY TAKEN UP BY PLANTS
      - "REACTIVE"
    - TYPICAL MEASURES ARE "TOTAL PHOSPHORUS" AND "ORTHOPHOSPHATE" OR DISSOLVED PHOSPHORUS
    - SOURCES: WEATHERING OF ROCKS

PHOSPHORUS



- P TYPICALLY LIMITING NUTRIENT IN AQUATIC SYSTEMS ---- THE IMPORTANT NUTRIENT
- YES, THE ONLY REAL SOURCE OF P IS FROM THE BREAKDOWN OF ROCK.
  - MINING (FERTILIZER)
  - SEDIMENTS (EROSION)
  - ORGANIC MATTER (WASTEWATER, RUNOFF, SEPTIC SYSTEMS)
  - DUST (EROSION)

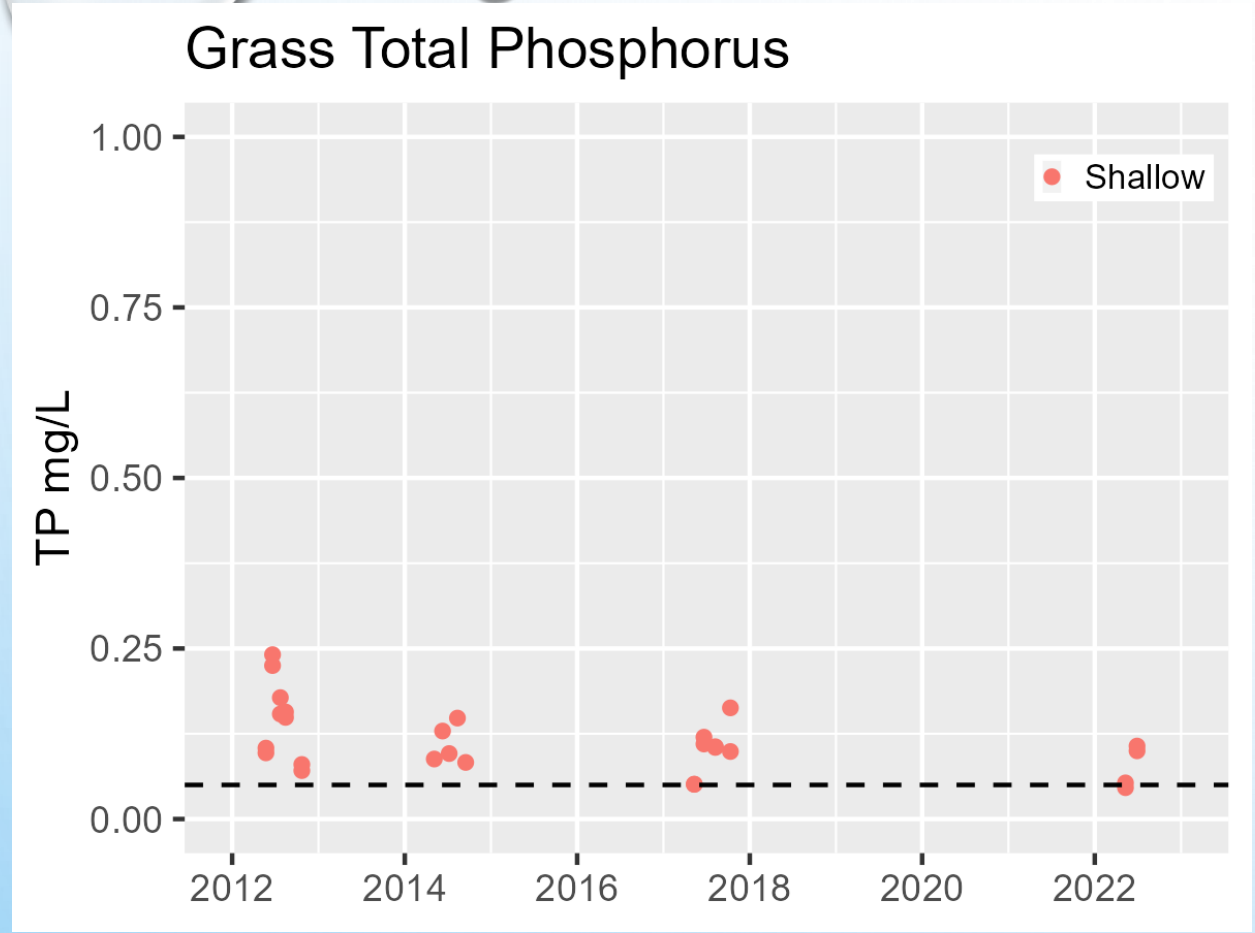
  - MOVEMENT BETWEEN FORMS OF PHOSPHORUS IS IMPORTANT!
  - WE OFTEN THINK OF PARTICULATE P AS AN UNUSABLE FORM – IT'S "LOCKED UP" … THIS IS NOT REALLY THE CASE
  - DISSOLVED PHOSPHORUS IS HIGHLY AVAILABLE

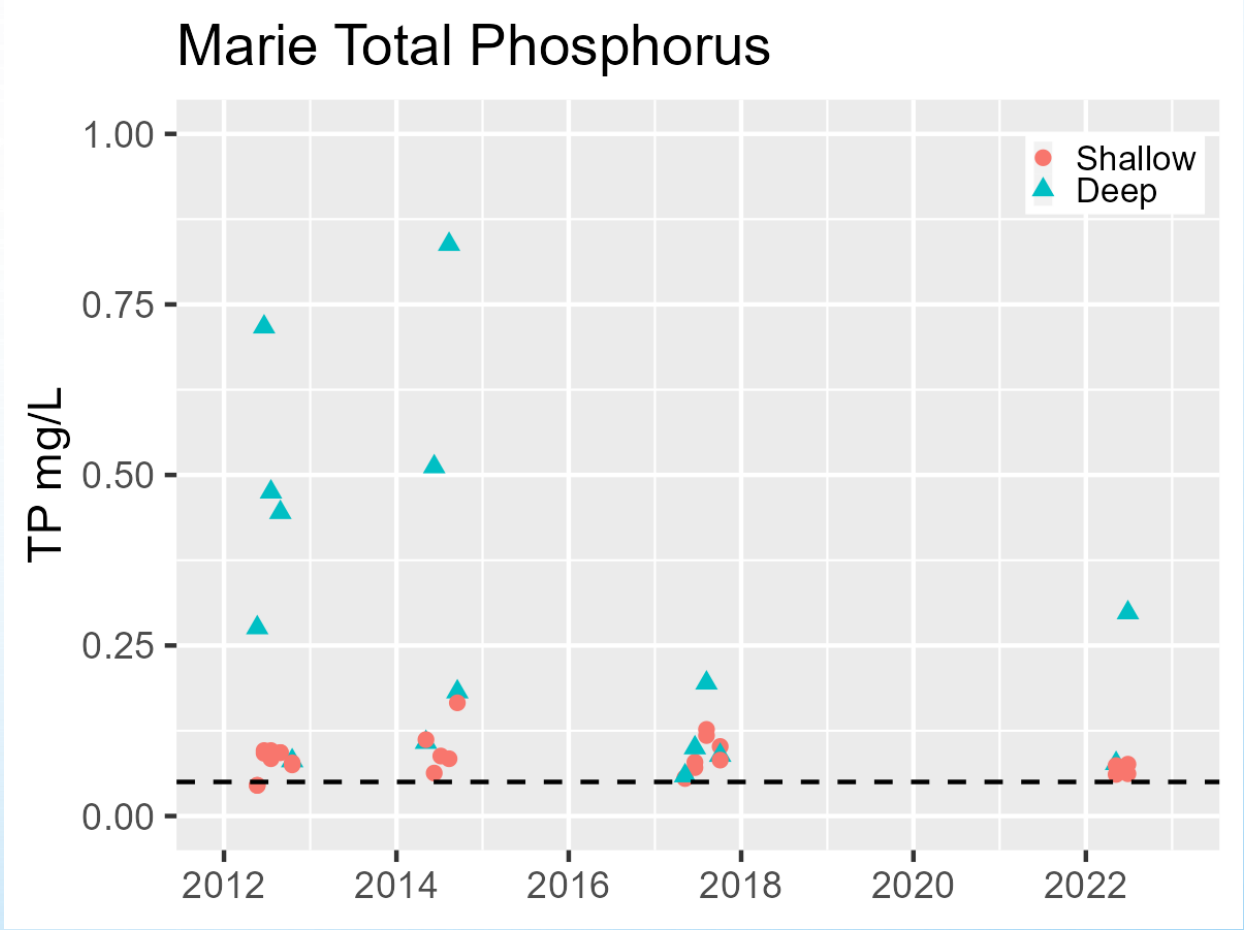


DEEP LAKES THERMALLY STRATIFY

- 3 DISTINCT LAYERS:
  - EIPLIMNION
  - METALIMNION
  - HYPOLIMNION (THIS IS WHERE THE MAGIC HAPPENS)

- HYPOLIMNION IS NATURALLY LOW IN OXYGEN. BUT MAY BECOME TOTALLY ANOXIC
- IN ANOXIC CONDITIONS, BACTERIA CAN WORK ON SEDIMENTS AND RELEASE BIOAVAILABLE P INTO THE WATER
- FOR A WHILE IT MOSTLY GETS STUCK IN THE BOTTOM WATER, BUT THEN DURING FALL TURNOVER IT IS RELEASED, CAN CAUSE ALGAL BLOOMS
- “INTERNAL LOADING” OR “LEGACY P”


Grass Total Phosphorus
TP mg/L
1.00
0.75
0.50
0.25
0.00
2012
2014
2016
2018
2020
2022
Shallow


Marie Total Phosphorus
TP mg/L
1.00
0.75
0.50
0.25
0.00
2012
2014
2016
2018
2020
2022
Shallow
Deep

SEDIMENT

- NOT ONLY IS SEDIMENT IMPORTANT BECAUSE IT'S THE BIGGEST SOURCE OF P, IT AFFECTS HABITAT AND CREATES RECREATIONAL ISSUES
- EROSION AND DEPOSITION
- MANY WAYS TO MEASURE. SOME OF THE MOST WIDELY AVAILABLE DATA IN THE CHAIN IS
  - "TOTAL SUSPENDED SOLIDS"
  - "NON-VOLATILE SUSPENDED SOLIDS"

SEDIMENT SOURCES

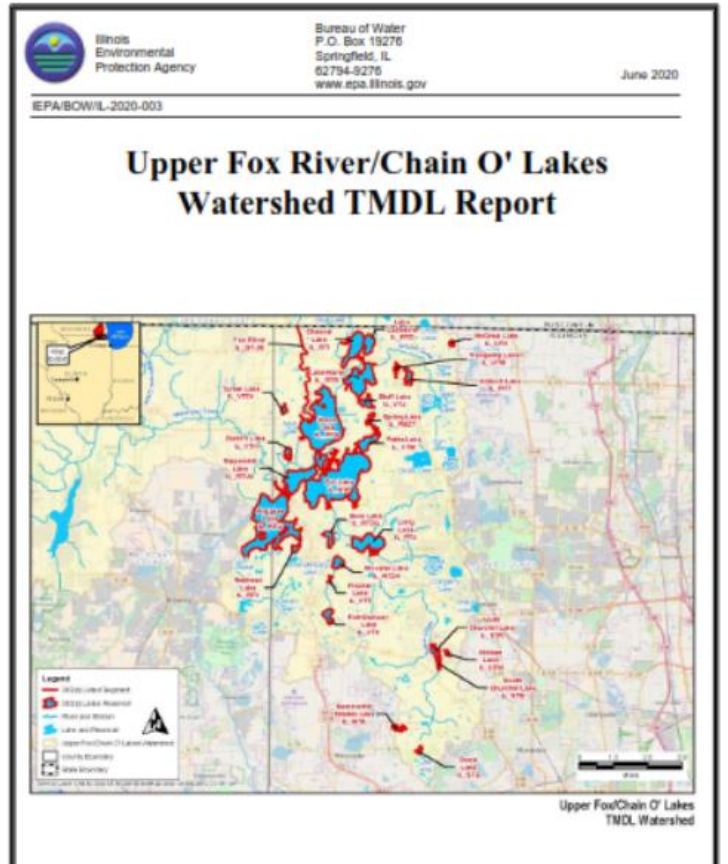
- VIA STREAMFLOW (EROSION):
  - AGRICULTURE
  - CONSTRUCTION
  - FOREST AND NATURAL LANDS
  - NATURAL & UNNATURAL STREAM SCOURING
- SHORELINE EROSION
- RESUSPENSION OF ALREADY DEPOSITED SEDIMENTS

TMDL

PHOSPHORUS

E. COLI

TOTAL SUSPENDED SOLIDS



- TOTAL MAXIMUM DAILY LOAD
- COMPLETED/ACCEPTED IN 2020
- MODELS THE REDUCTIONS IN LOADS OF POLLUTANTS NEEDED TO MEET WATER QUALITY STANDARDS
- VERY GENERALIZED FROM THE PERSPECTIVE OF PLANNING REDUCTIONS
- GIVES GREAT INFORMATION ON SOURCES AND LEVELS OF POLLUTANTS IN ALL THE LAKES OF THE CHAIN

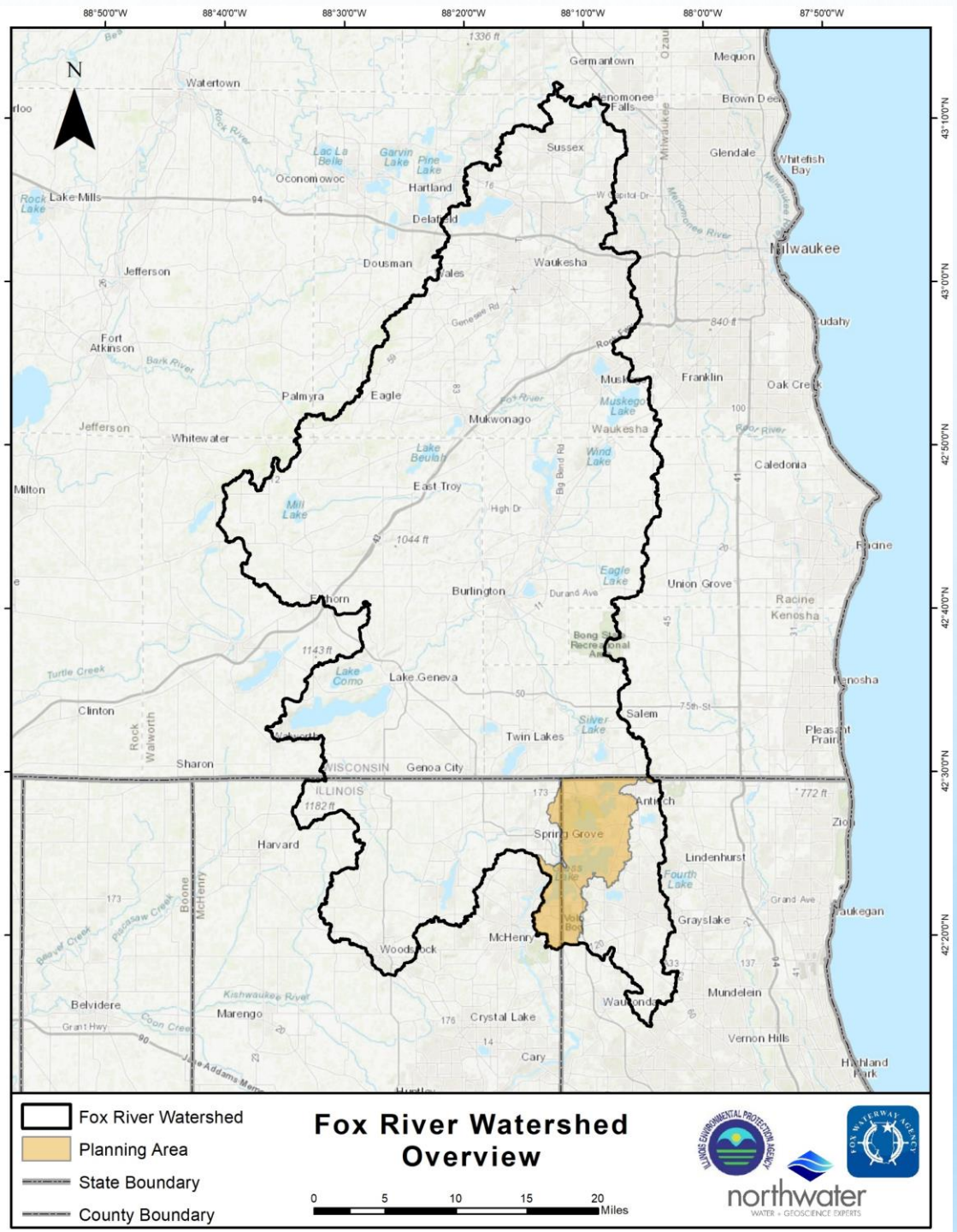
WATER QUALITY DATA COLLECTION

- ILLINOIS EPA
- LAKE COUNTY HEALTH DEPARTMENT
- VOLUNTEERS
- US GEOLOGICAL SURVEY
- MANY OTHERS INTERMITTENTLY
  - USGS
  - EPA
  - IDNR

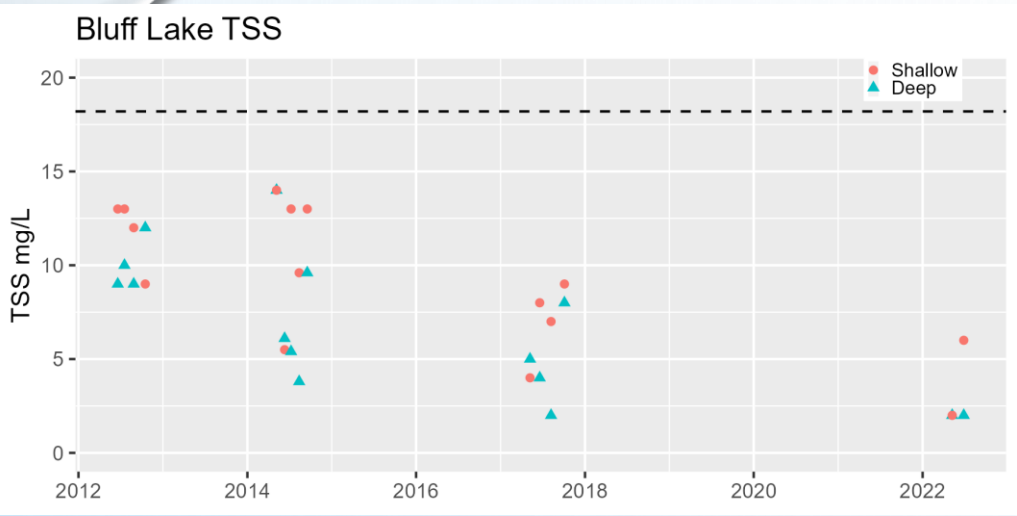
PLANNING AREA VS WATERSHED

PLANNING AREA:
57 SQUARE MILES

WATERSHED:
~1200 SQUARE MILES

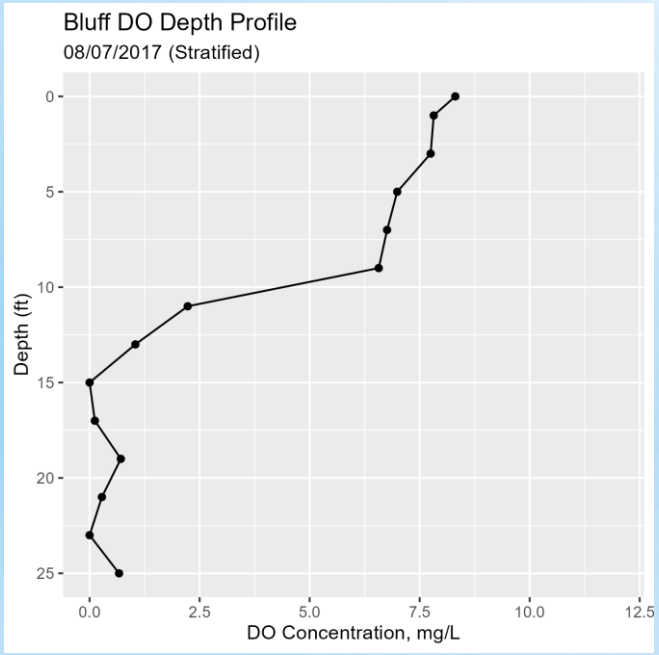


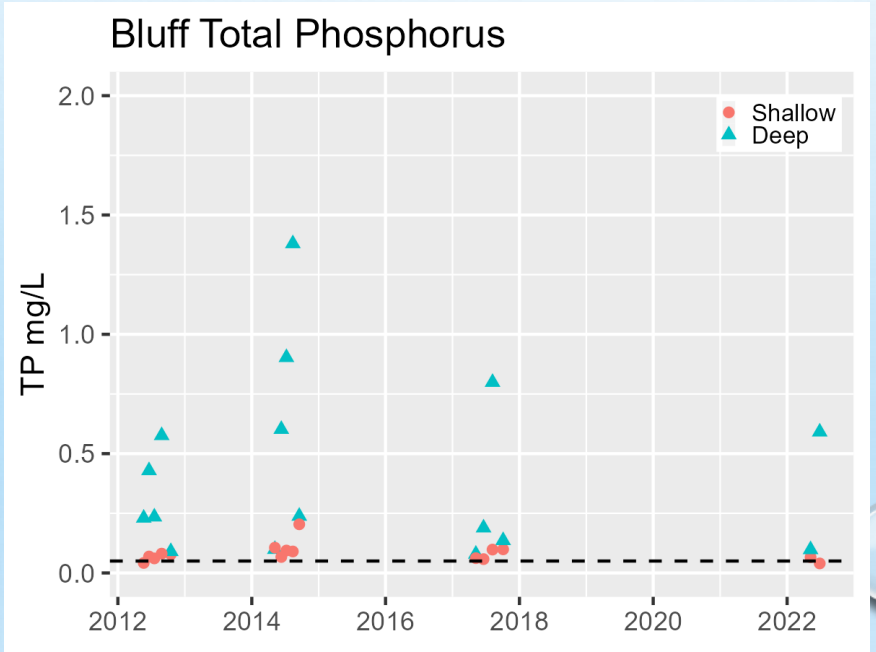
BLUFF LAKE



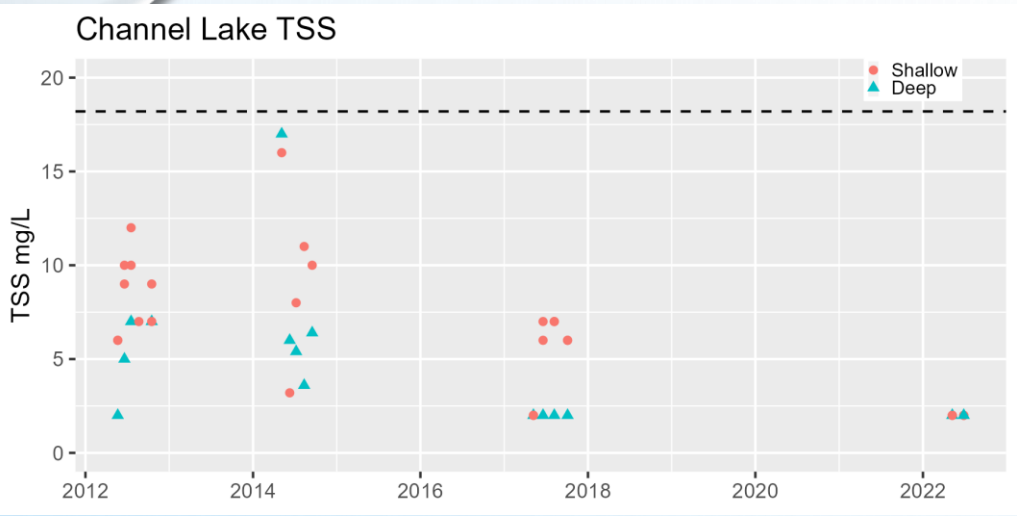
- ELEVATED PHOSPHORUS
  - STRATIFICATION RELEASES ADDITIONAL P
- TSS APPEARS TO BE DROPPING OVER TIME
- INTERNAL LOADING IS IMPORTANT HERE

Lake	Total P Load	Internal Load	Watershed Load	Upstream Lake Load	Point Source Load
Bluff	8.25	1.36	0.86	6.03	



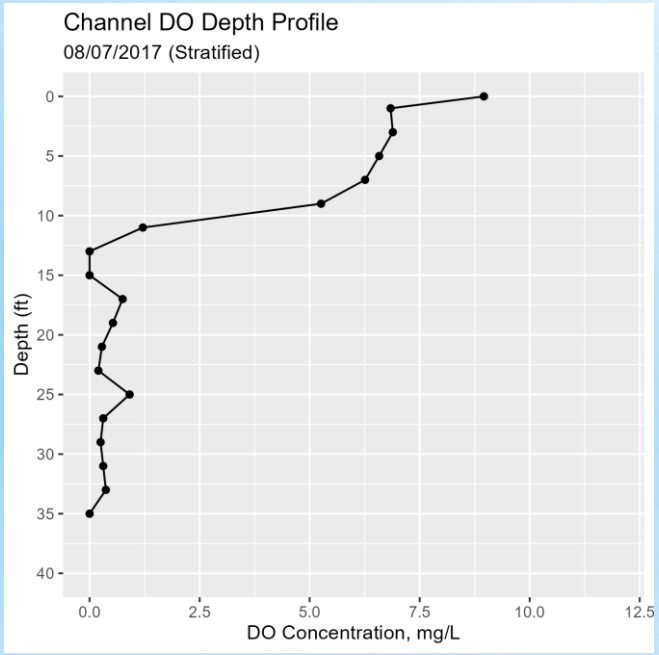


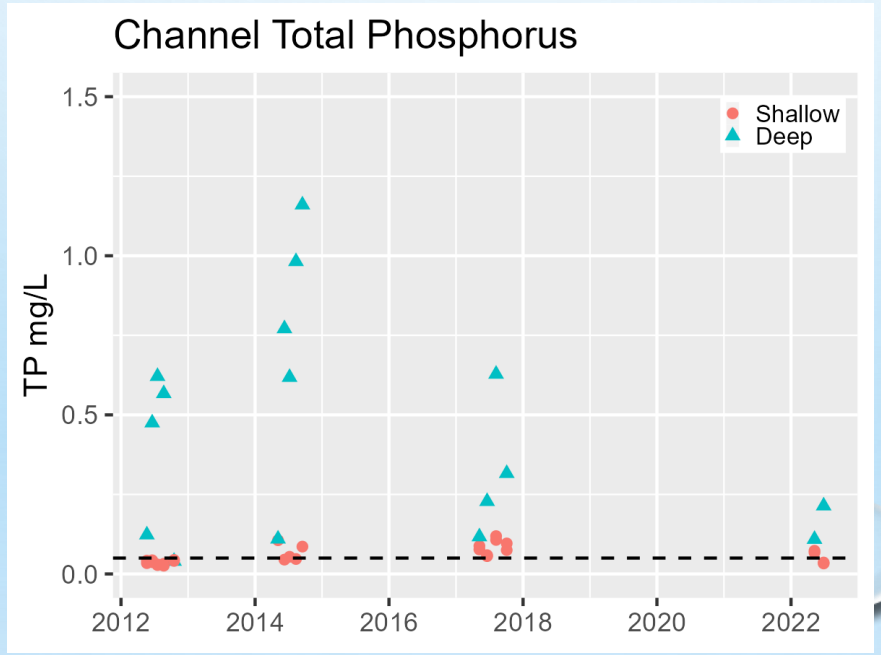
CHANNEL LAKE



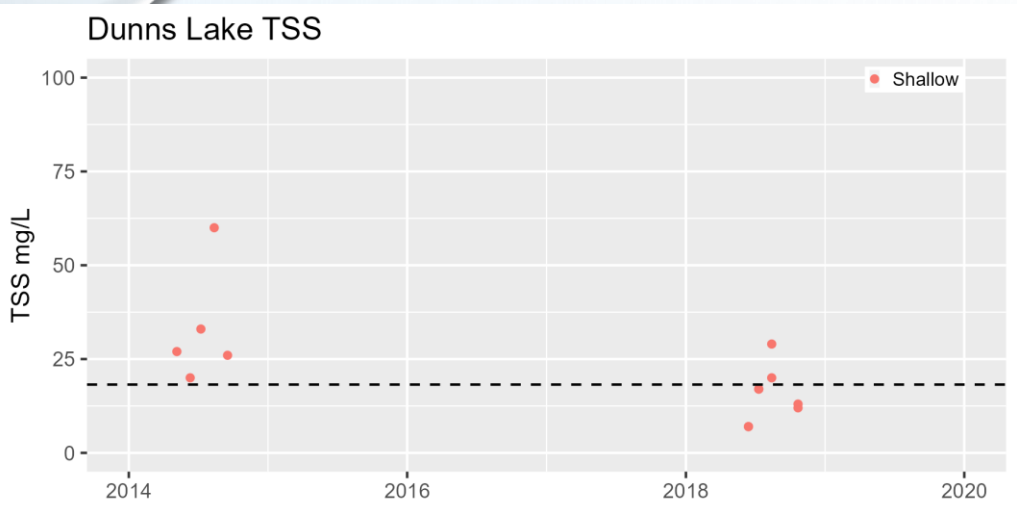
- ELEVATED PHOSPHORUS
  - STRATIFICATION RELEASES ADDITIONAL P
- TSS APPEARS TO BE DROPPING OVER TIME

Lake	Total P Load	Internal Load	Watershed Load	Upstream Lake Load	Point Source Load
Channel	13.4	2.8	10.6		



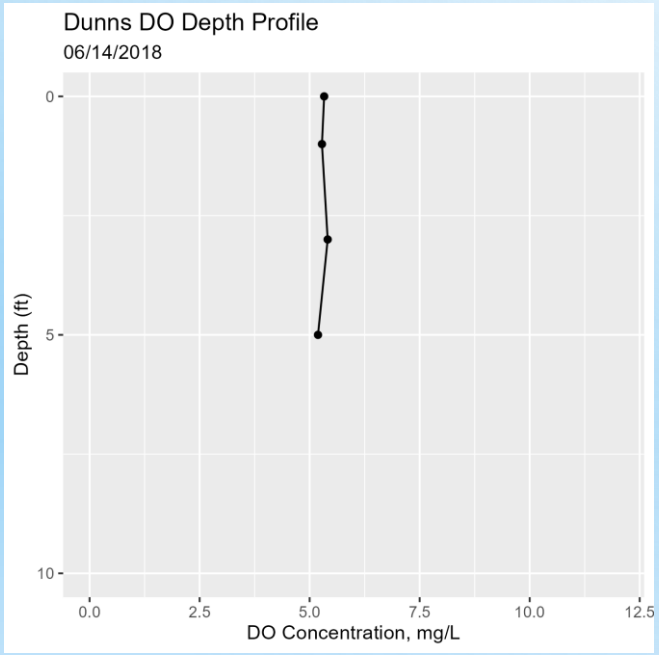


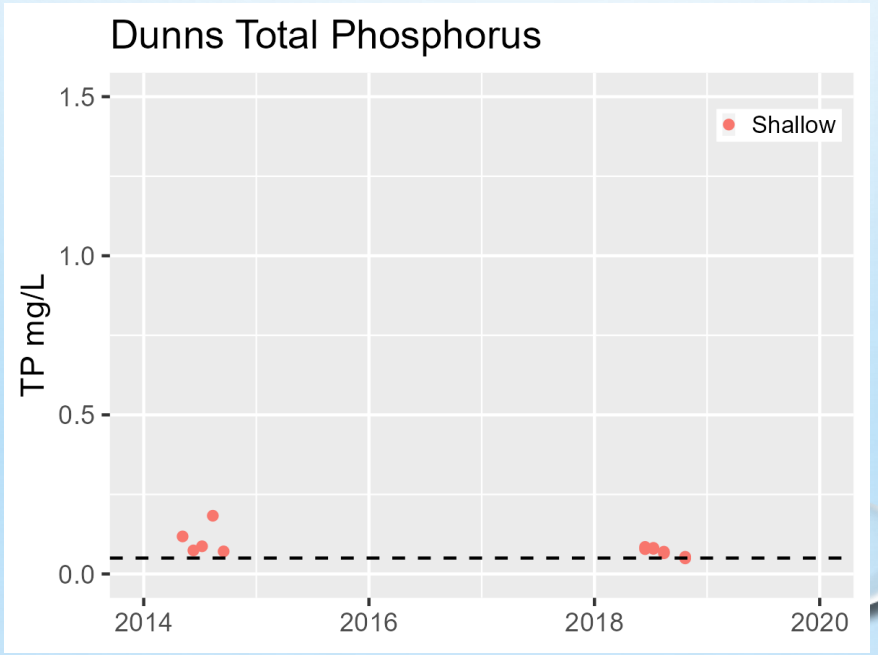
DUNNS LAKE



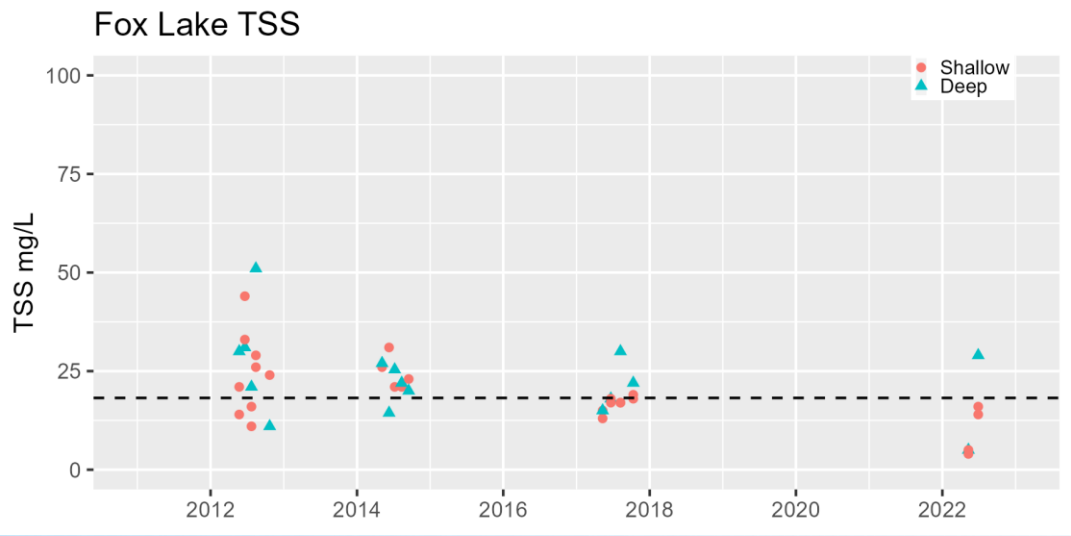
- ELEVATED PHOSPHORUS
- ELEVATED TSS
- POINT SOURCE – NOW DECOMISSIONED (2022)

Lake	Total P Load	Internal Load	Watershed Load	Upstream Lake Load	Point Source Load
Dunns	1.34	0.38	0.33		0.63



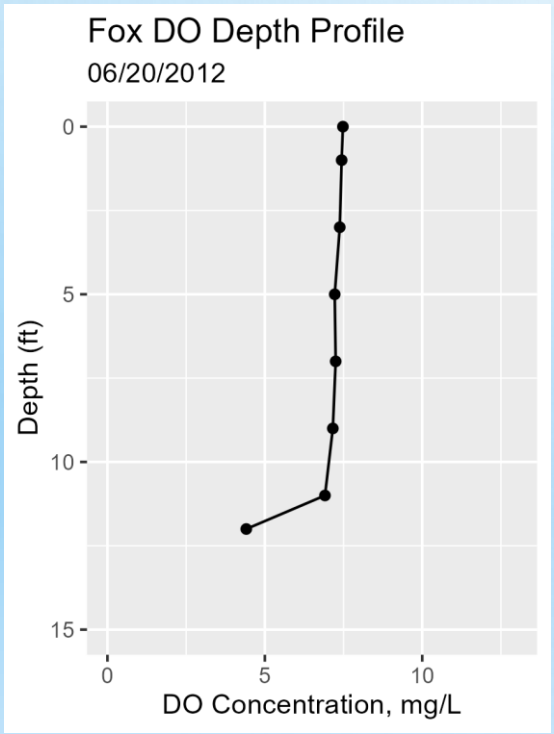


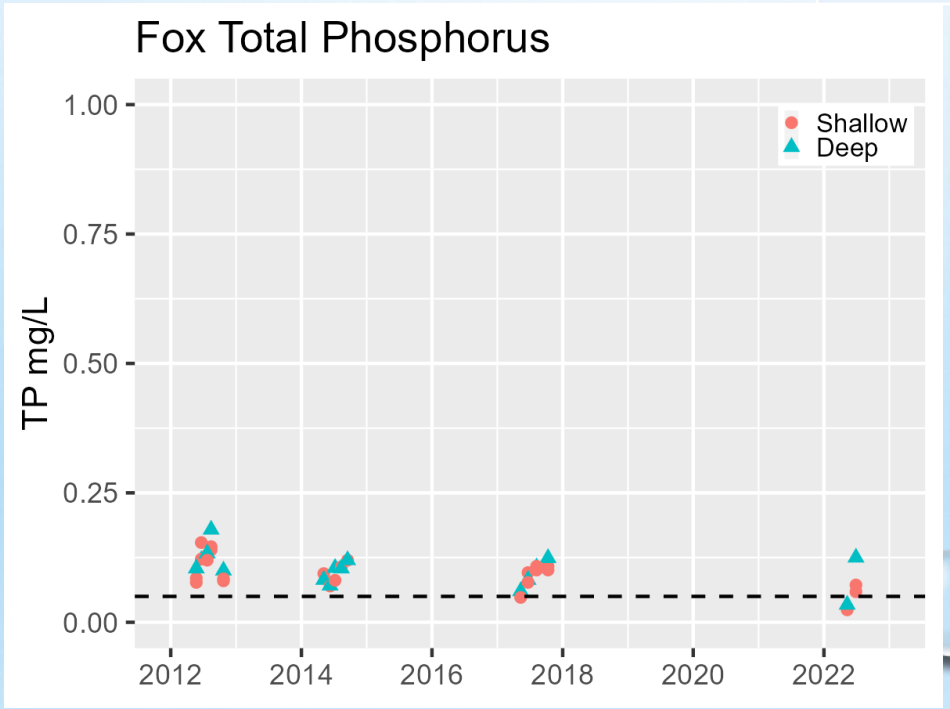
FOX LAKE



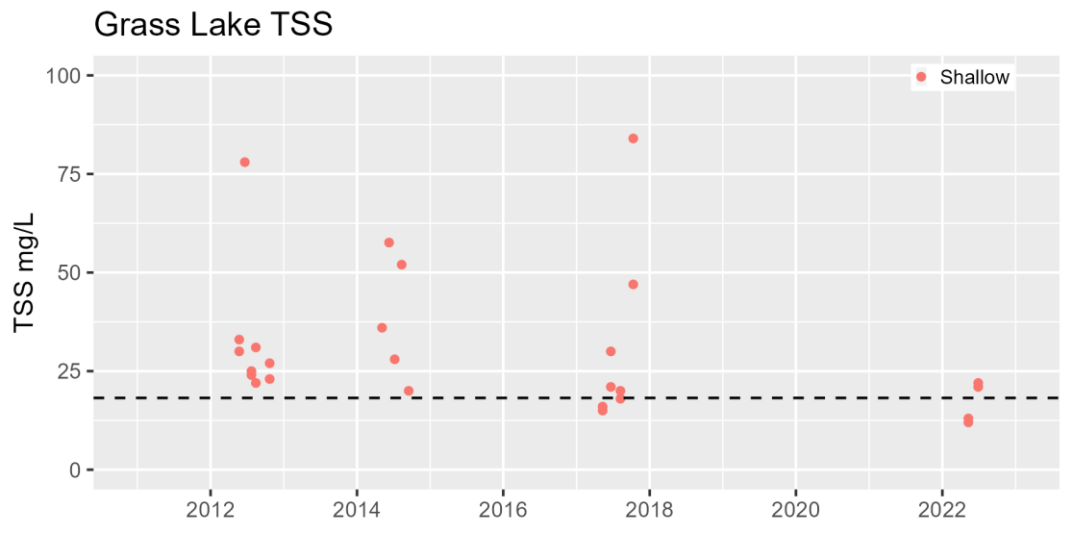
- ELEVATED PHOSPHORUS
- ELEVATED TSS
- WATERSHED LOAD IS FAIRLY SMALL
- INTERNAL LOADING IMPORTANT

Lake	Total P Load	Internal Load	Watershed Load	Upstream Lake Load	Point Source Load
Fox	183	19.41	4.34	158.86	

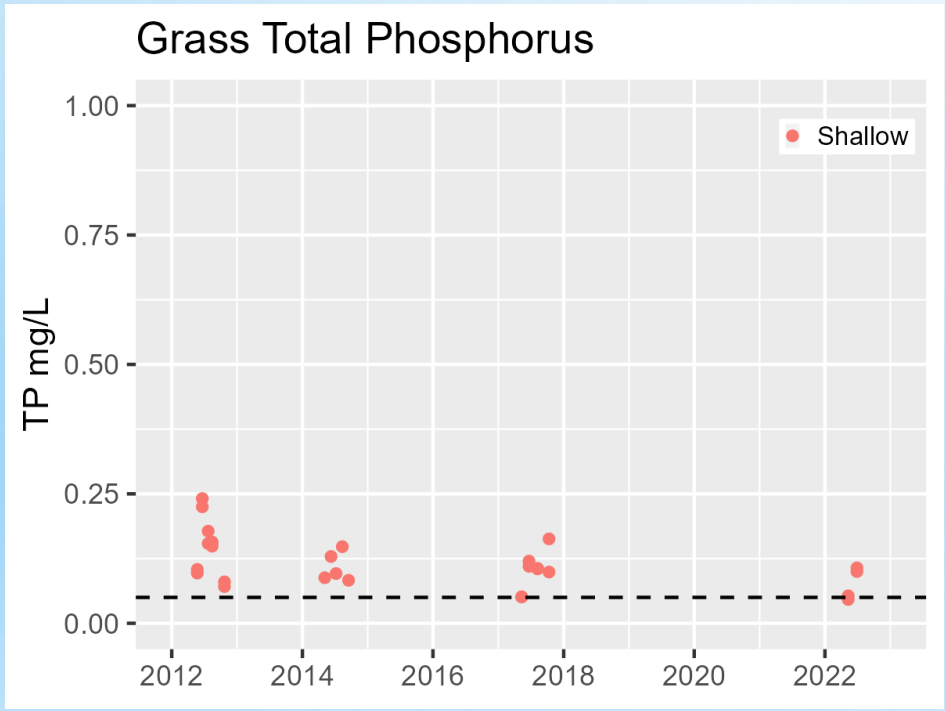




GRASS LAKE

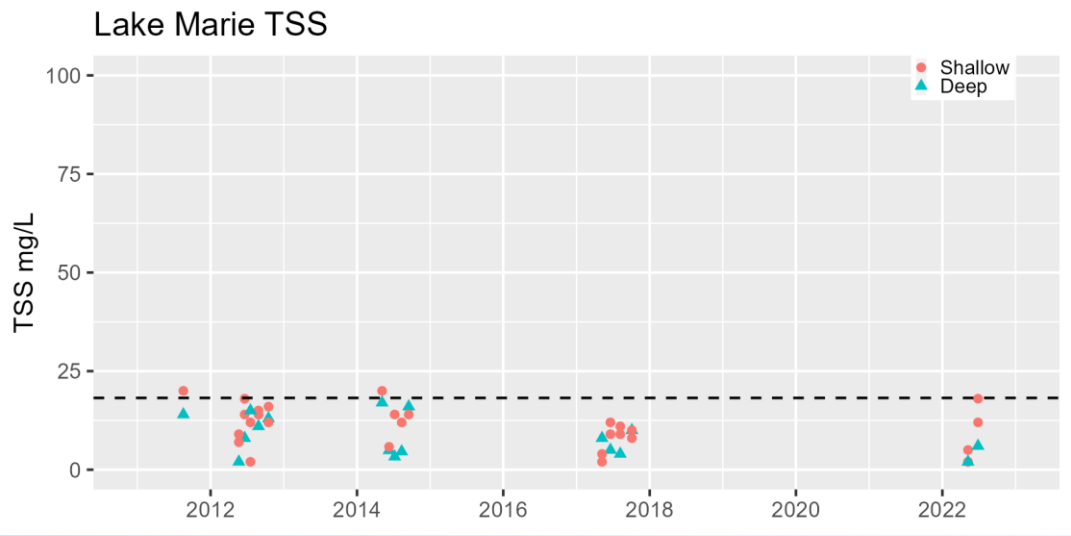


- ELEVATED PHOSPHORUS
- ELEVATED TSS
- INTERNAL LOADING IMPORTANT
- BIG WATERSHED, BIG LOAD



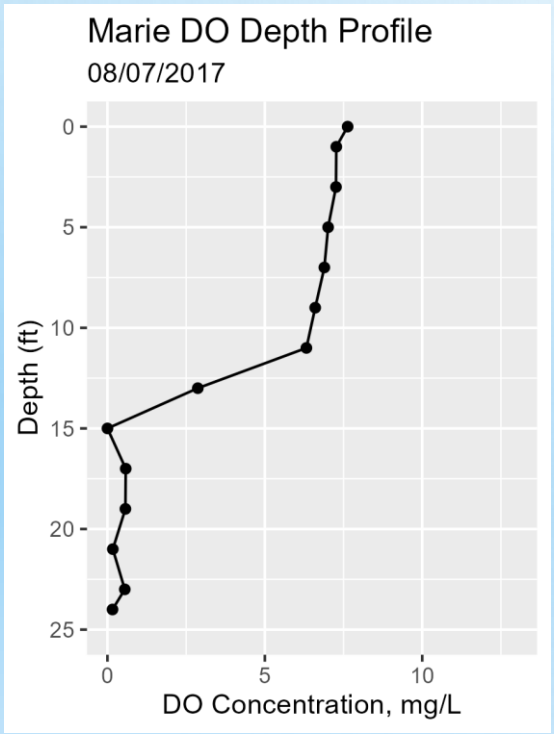
Lake	Total P Load	Internal Load	Watershed Load	Upstream Lake Load	Point Source Load
Grass	424	29.4	395		

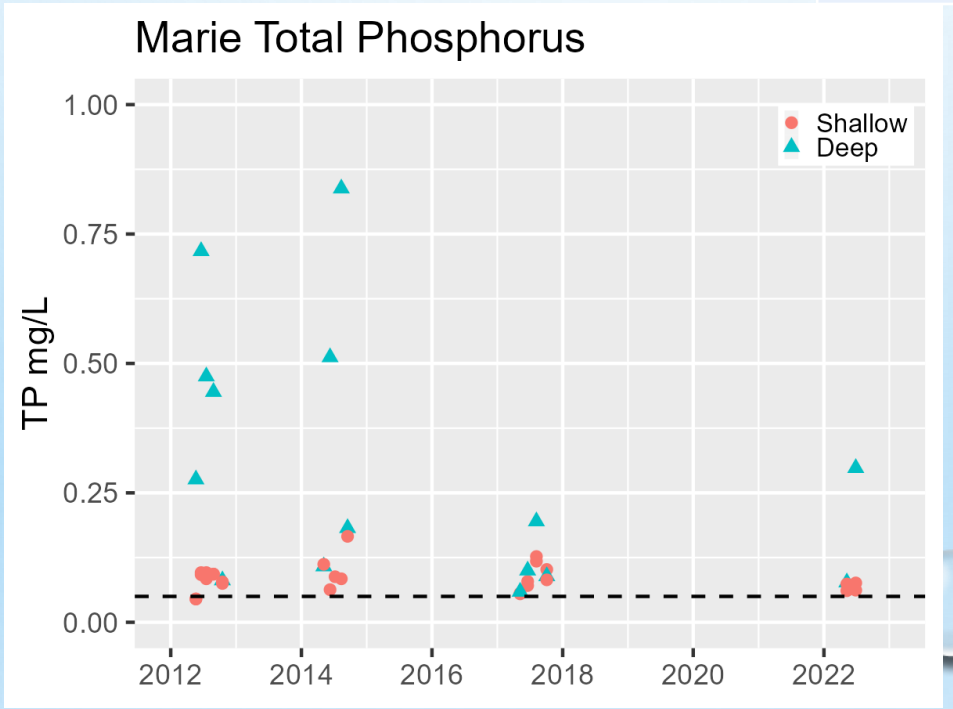
LAKE MARIE



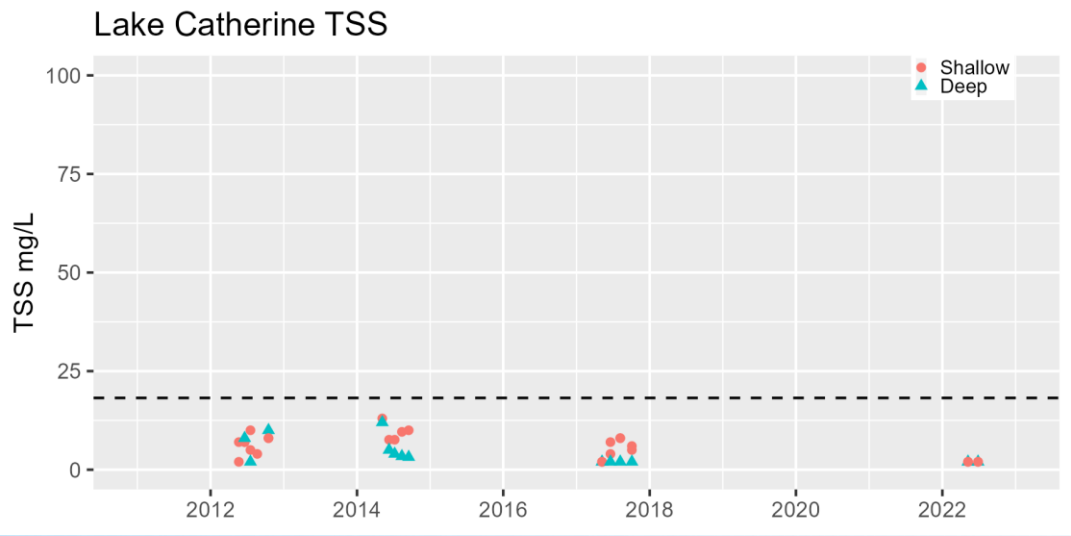
- ELEVATED PHOSPHORUS
- INTERNAL & POINT SOURCE LOADING IMPORTANT
- WATERSHED LOAD IMPORTANT

Lake	Total P Load	Internal Load	Watershed Load	Upstream Lake Load	Point Source Load
Marie	32.7	6.68	11.13	6.64	8.25



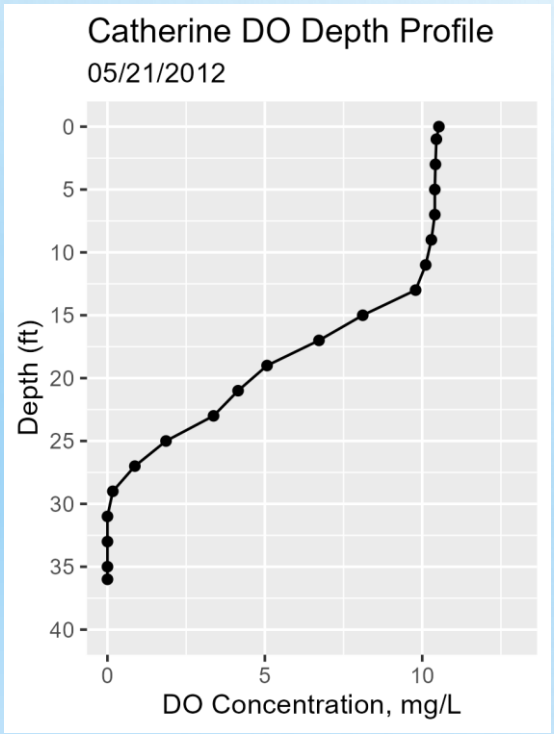


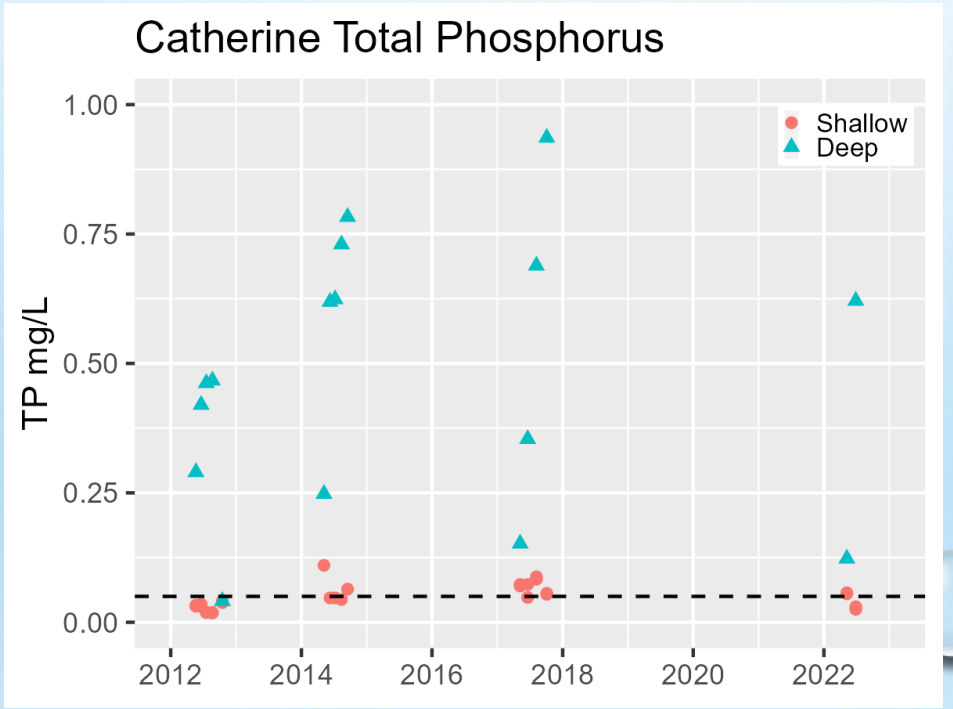
LAKE CATHERINE



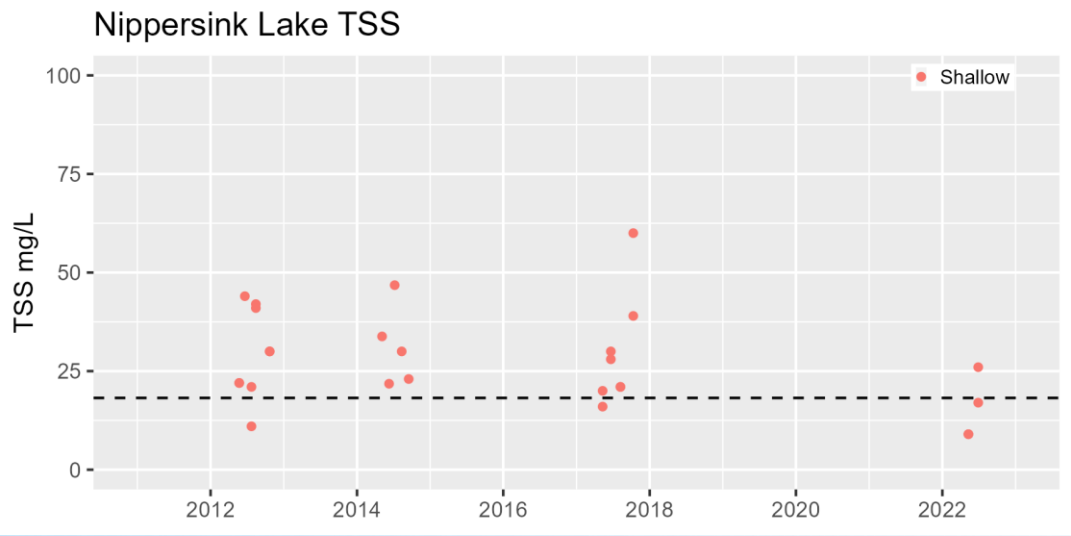
- ELEVATED PHOSPHORUS
- INTERNAL & POINT SOURCE LOADING IMPORTANT
- WATERSHED LOAD IMPORTANT

Lake	Total P Load	Internal Load	Watershed Load	Upstream Lake Load	Point Source Load
Catherine	5.22	1.32	3.9		



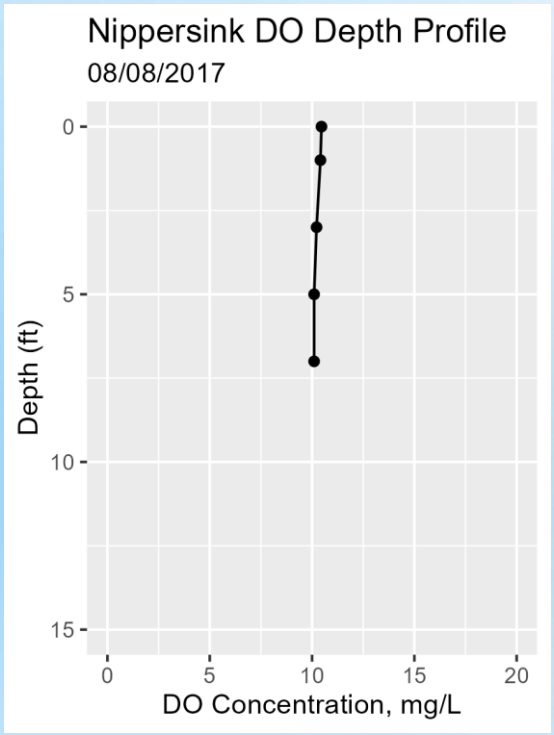


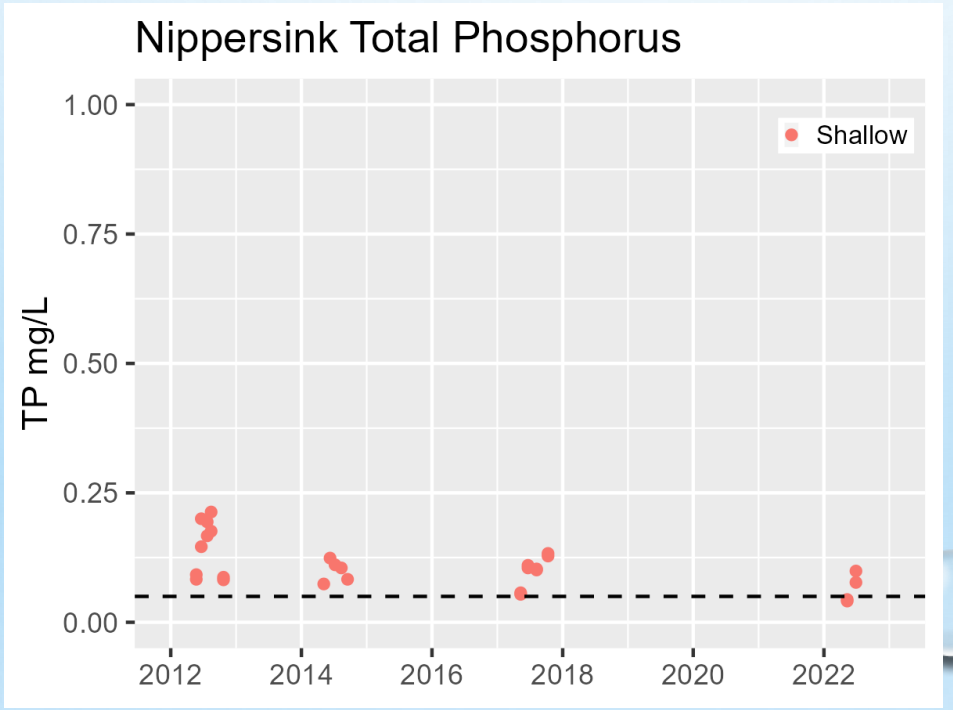
NIPPERSINK LAKE



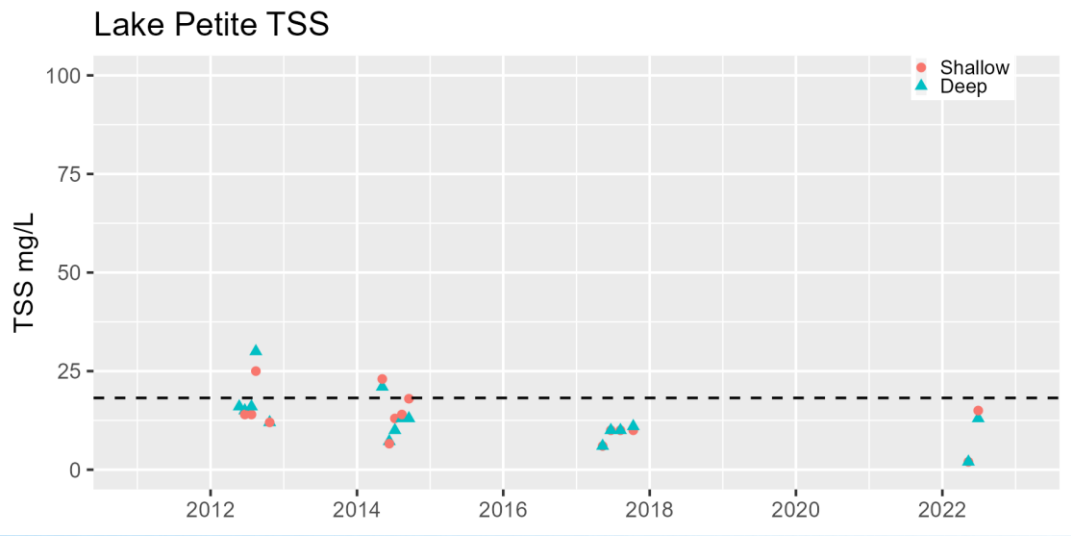
- ELEVATED PHOSPHORUS
- ELEVATED TSS
- INTERNAL LOADING IMPORTANT

Lake	Total P Load	Internal Load	Watershed Load	Upstream Lake Load	Point Source Load
Nippersink	269	25.2	0.5	242.8	



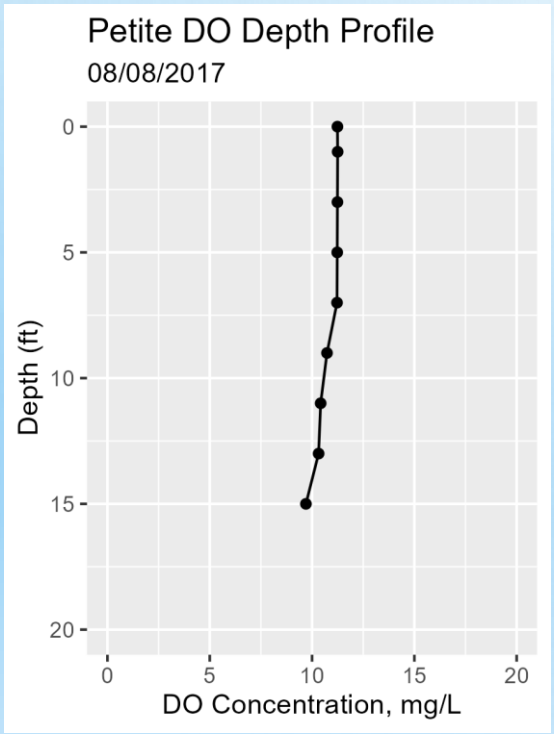


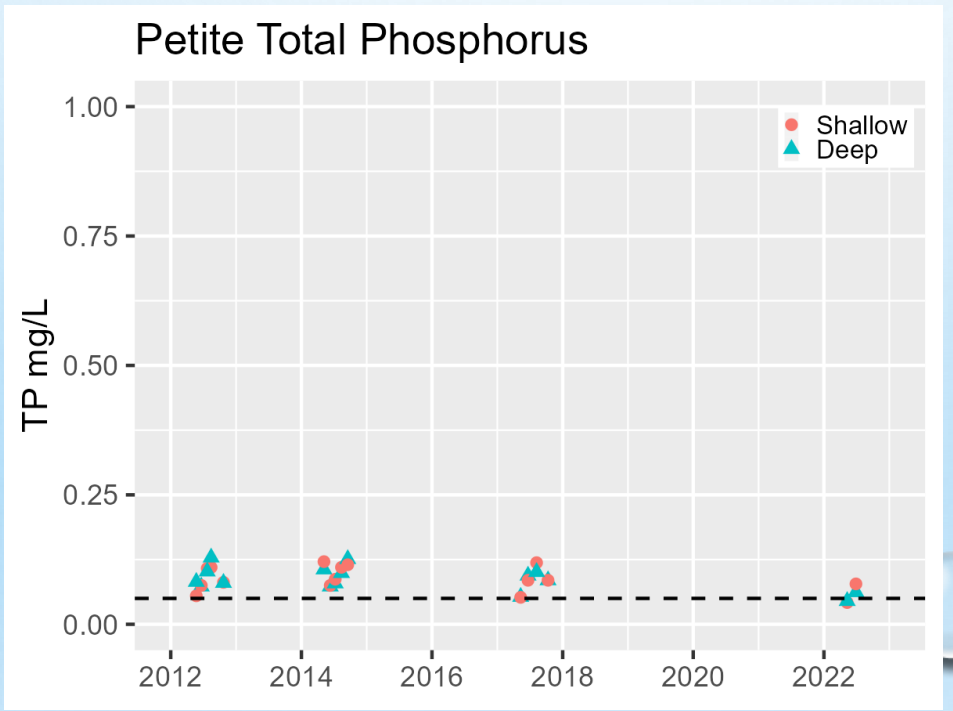
PETITE LAKE



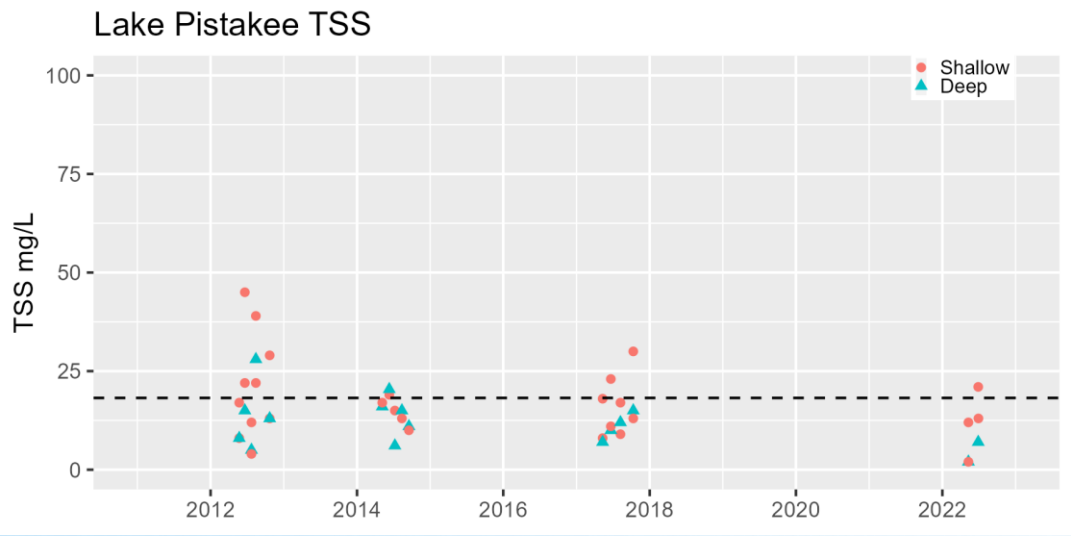
- ELEVATED PHOSPHORUS
- ELEVATED TSS
- INTERNAL LOADING IMPORTANT

Lake	Total P Load	Internal Load	Watershed Load	Upstream Lake Load	Point Source Load
Petite	15.6	4.82	1.17	9.62	



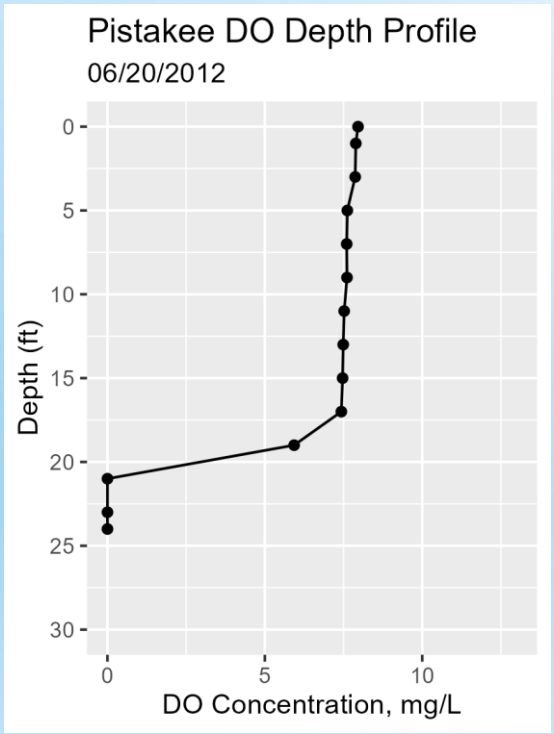


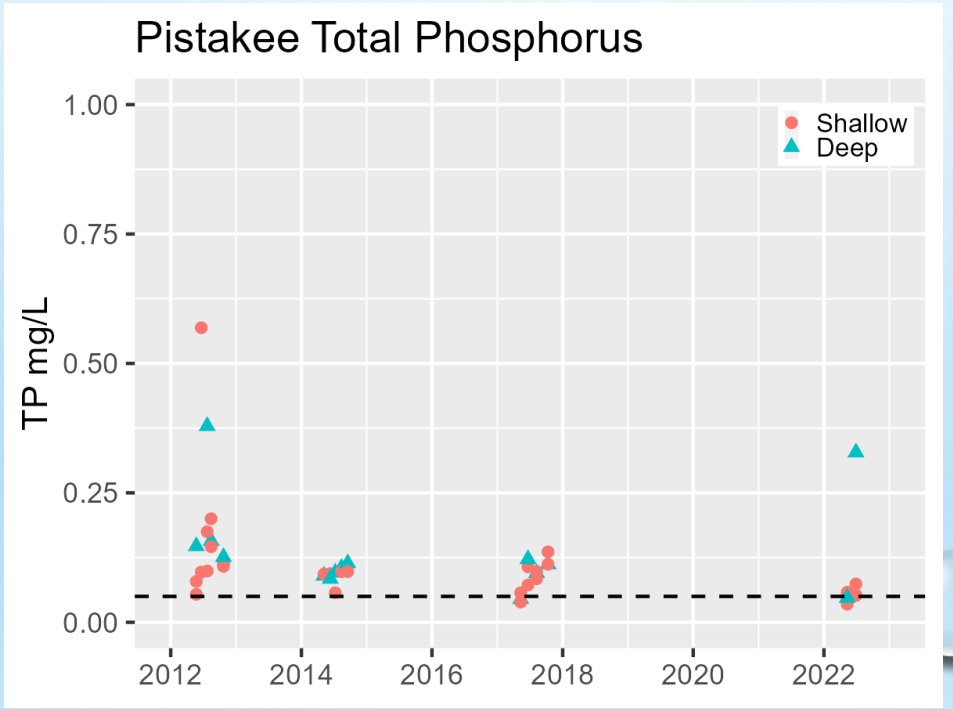
PISTAKEE LAKE



- ELEVATED PHOSPHORUS
- ELEVATED TSS
- INTERNAL LOADING IMPORTANT

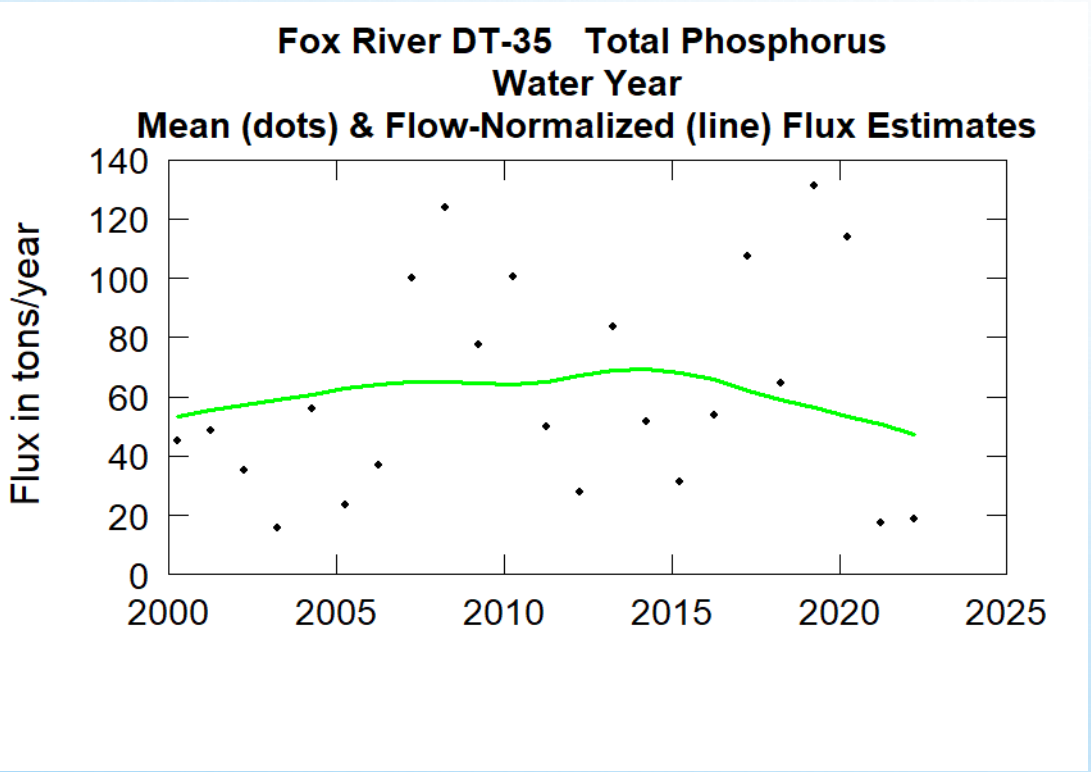
Lake	Total P Load	Internal Load	Watershed Load	Upstream Lake Load	Point Source Load
Pistakee	747	5.52	241.8	394	15.21

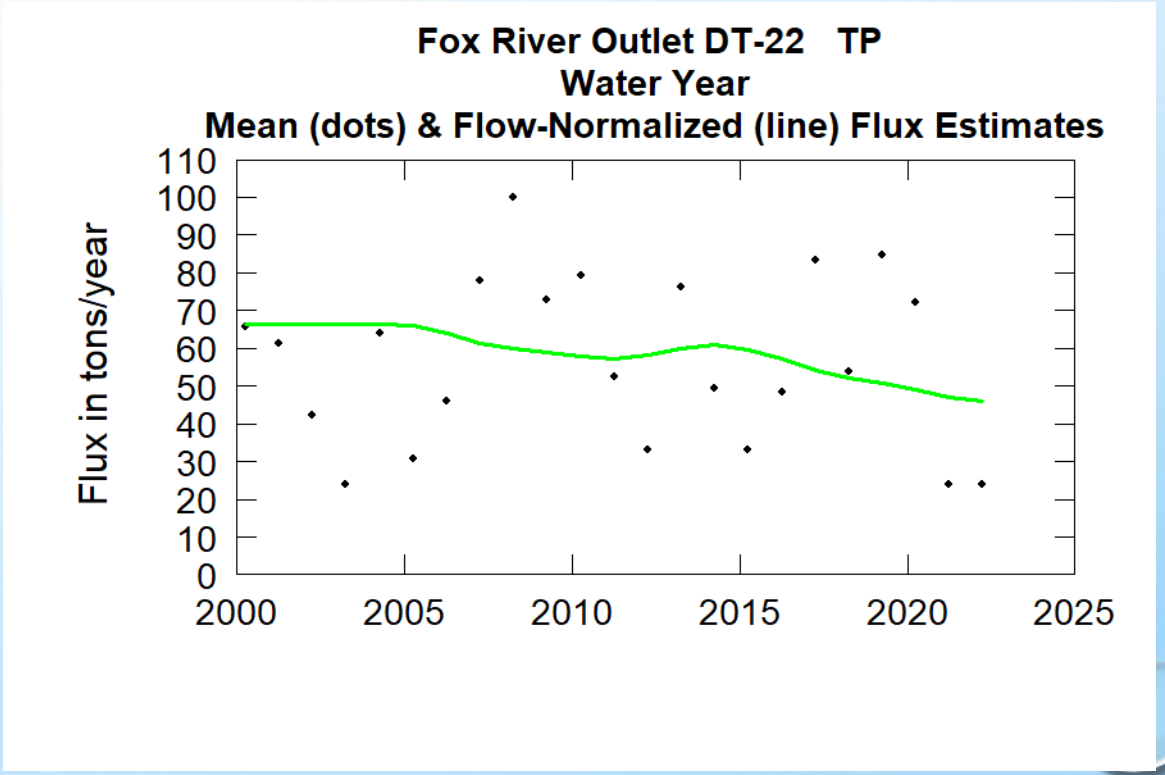




PRELIMINARY NUTRIENT TREND RESULTS

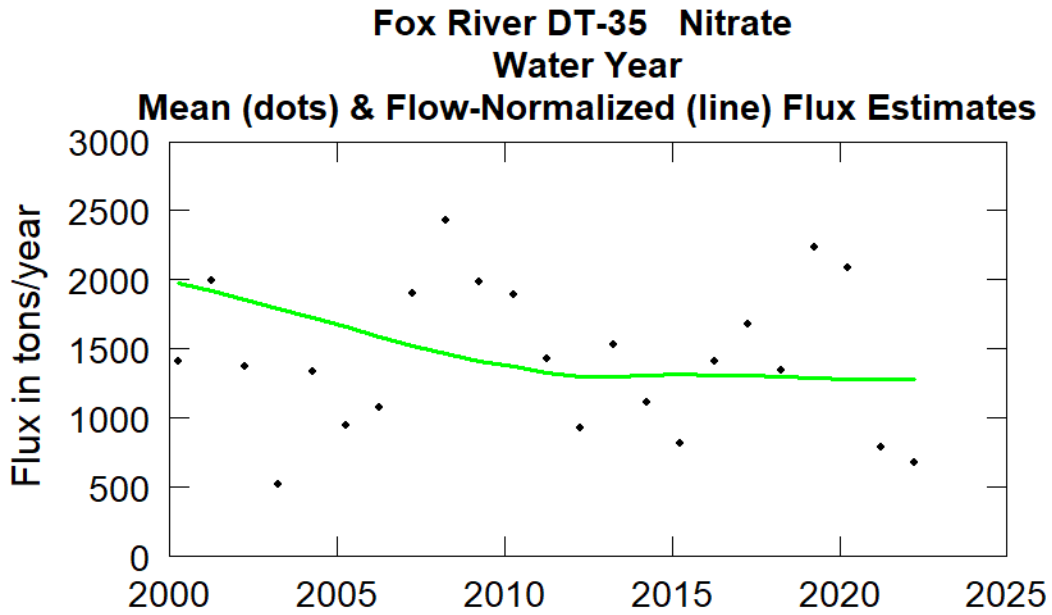
- TOTAL PHOSPHORUS

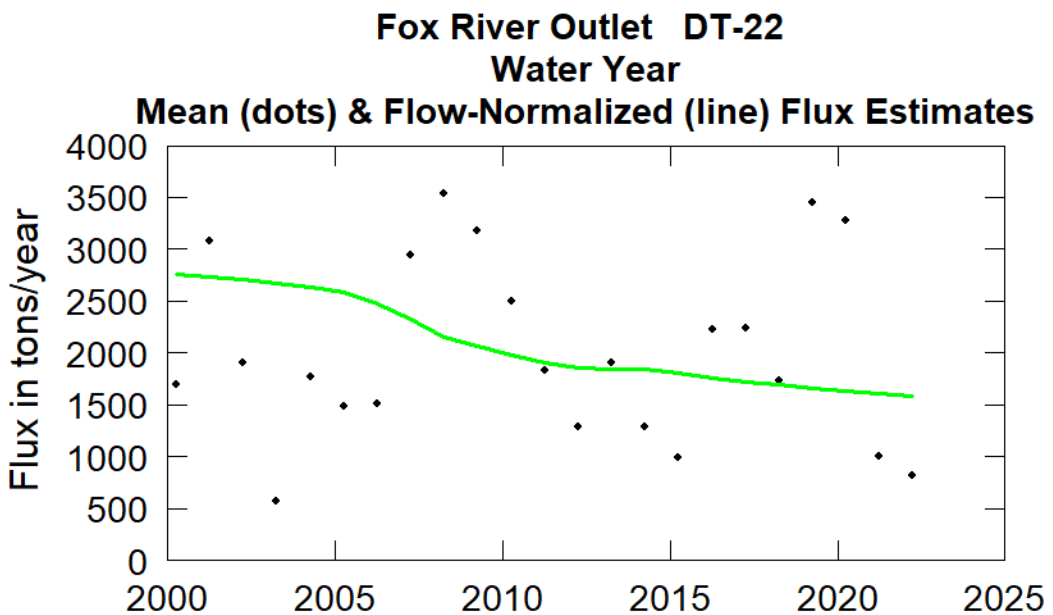




PRELIMINARY NUTRIENT TREND RESULTS

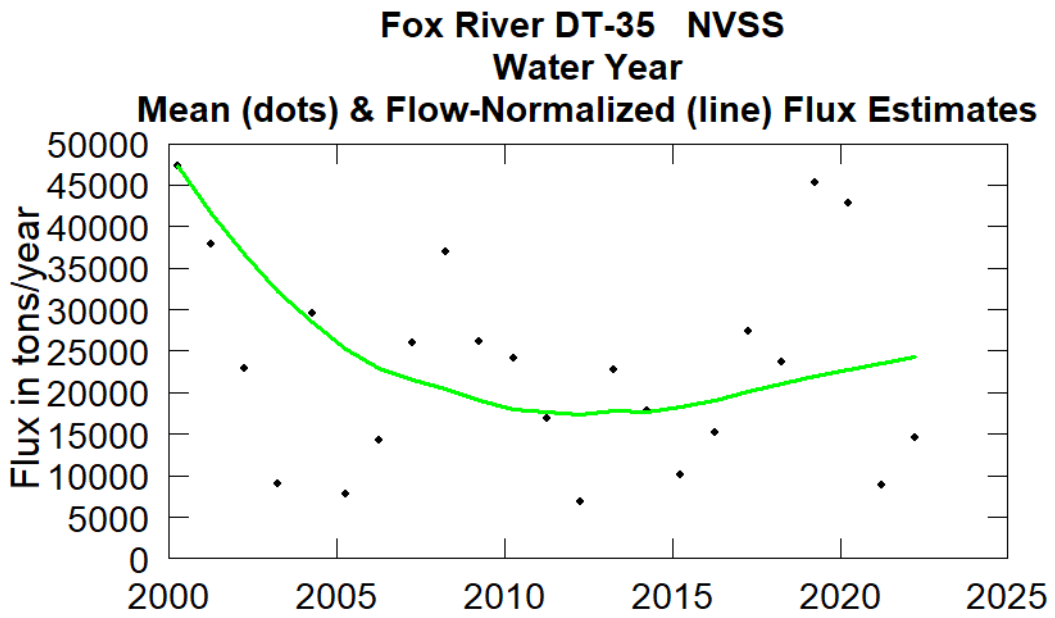
- NITRATE

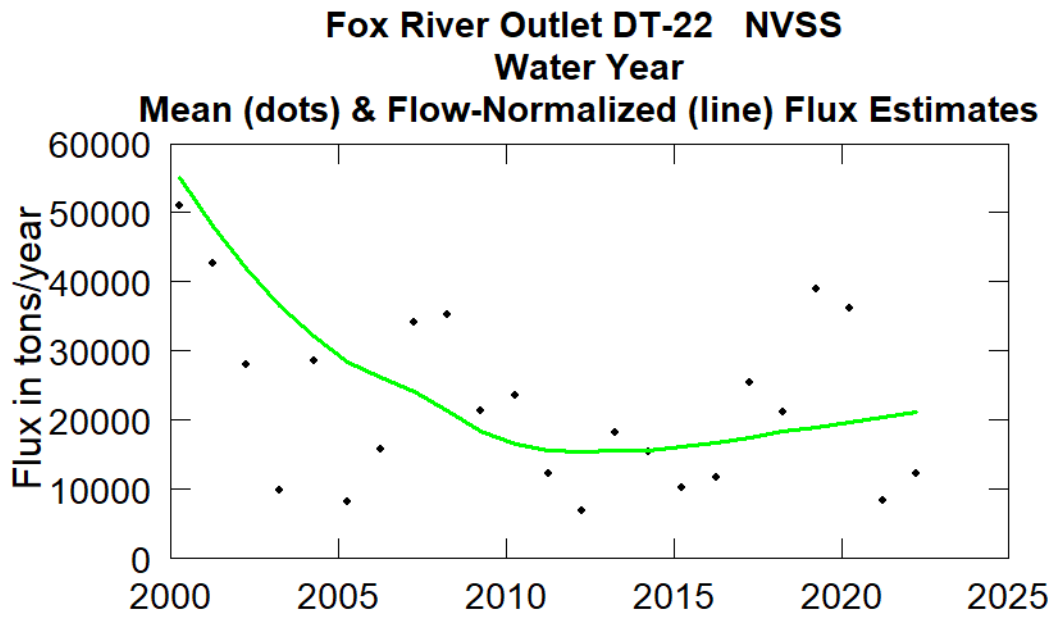




PRELIMINARY NUTRIENT TREND RESULTS

- NON-VOLATILE SUSPENDED SOLIDS



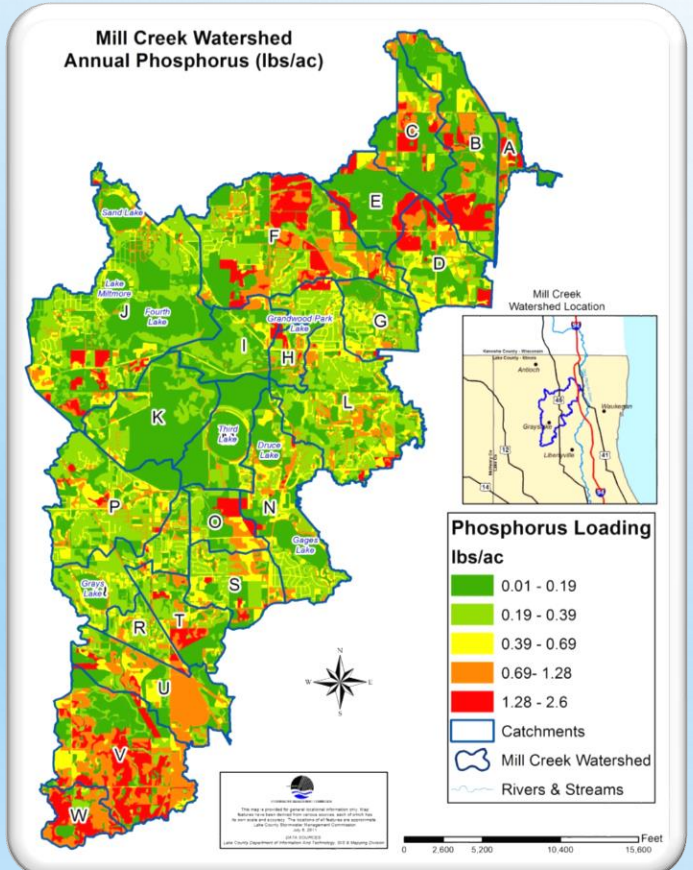


PRELIMINARY NUTRIENT TREND RESULTS

FROM FOX RIVER

- TOTAL SUSPENDED SOLIDS

HOW DO WE FIX ALL THIS?



- BEST MANAGEMENT PRACTICES
- POLICY
- COORDINATION
- PRIORITIZATION
- MAKE IT COST EFFECTIVE!!!!!

POLICY & COORDINATION

- TMDL
- CROSS-BORDER COORDINATION
- LOCAL ACTION
  - P FERTILIZER BANS

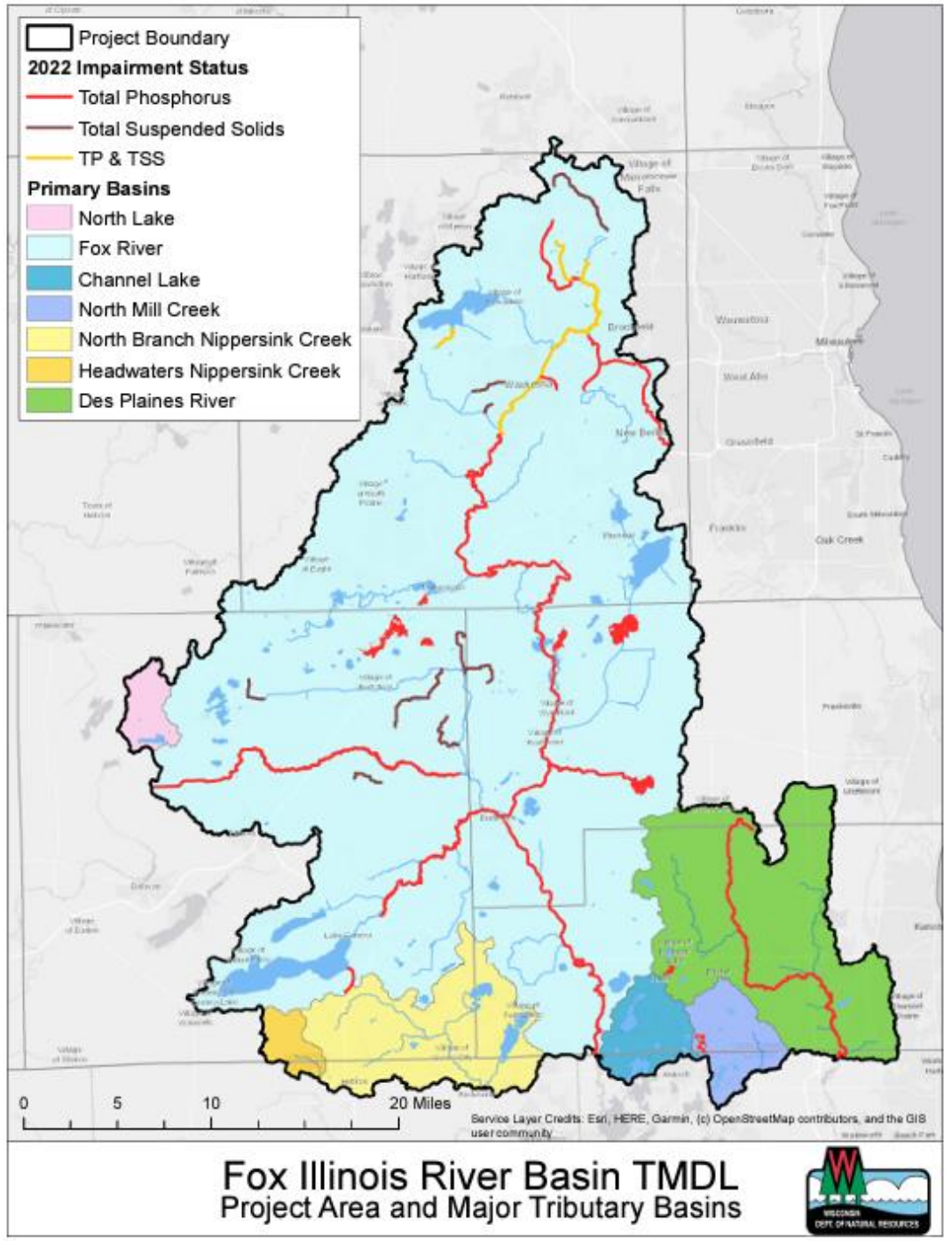
The 11th Annual

Fox River Summit

Thursday, March 16th, 2023

Summit Agenda Here

Register Here



SHORELINE RESTORATION / STABILIZATION

- PREVENT SHORELINE EROSION
- PROVIDE HABITAT
- TRAP OR REMOVE NUTRIENTS

LAKE BUFFERS

- FILTER RUNOFF AND SEDIMENT
- RESISTS EROSION
- WILDLIFE HABITAT
- MAY PREVENT GEESE

RAIN GARDENS

- FILTER RAINWATER
- PROVIDE HABITAT
- INCREASE GROUNDWATER INFILTRATION
- SLOW RUNOFF

BIOSWALE

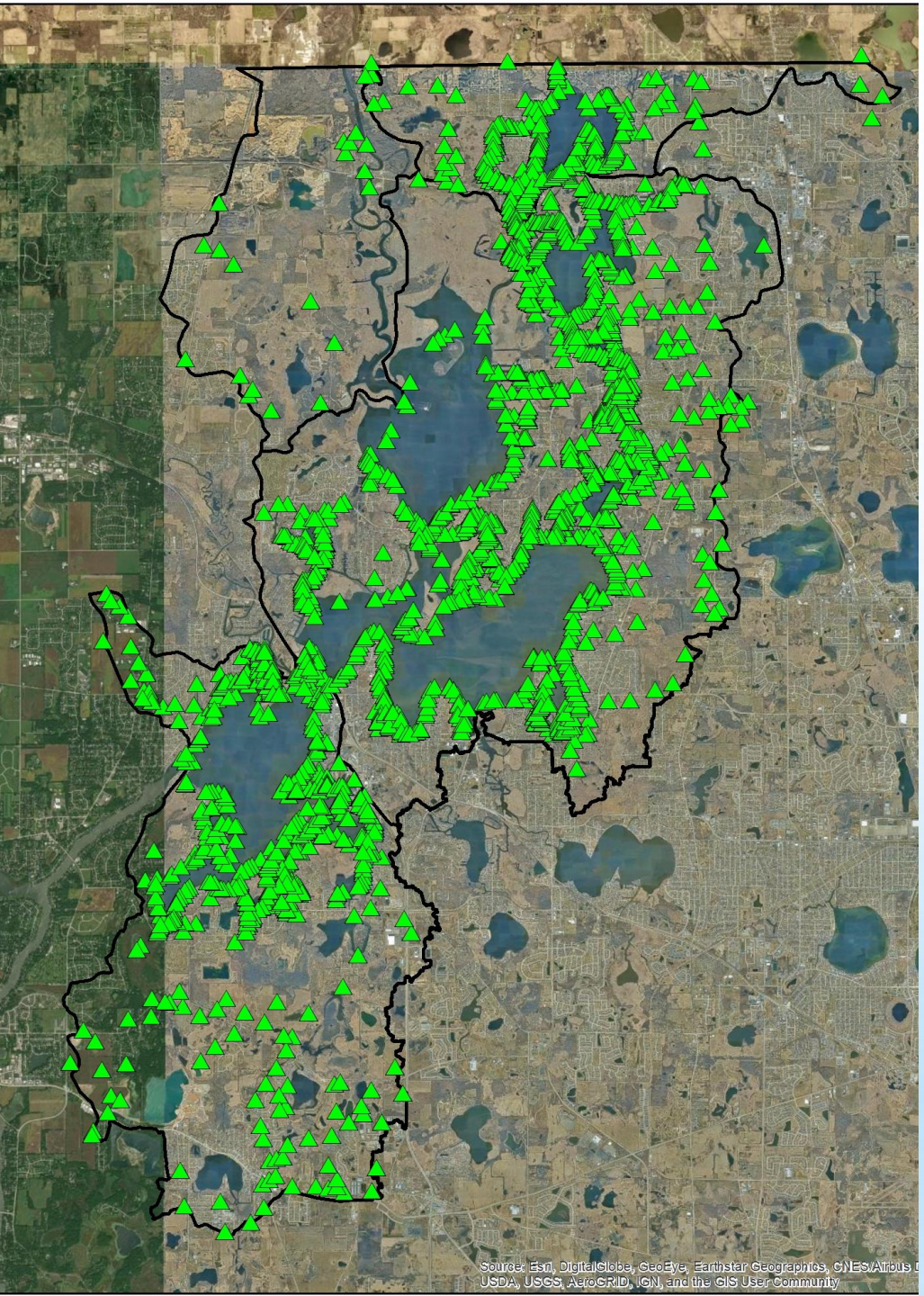
- SLOW WATER
- DROP SEDIMENT

WETLAND AND FLOODPLAIN RESTORATION

- CAN BE LARGE SCALE OR SMALL
- TRAP SEDIMENT AND

AG BMPS

- COVER CROPS
- WATERWAYS
- WASCOB
- BORDERS



WE NEED YOUR HELP

- WE CAN DIRECTLY AFFECT THE SITUATION IN OUR PLANNING AREA
- WE NEED HELP IDENTIFYING PROJECTS

SUBMIT POTENTIAL PROJECTS AND LOCATIONS OF CONCERNS AND ISSUES

FOX WATERWAY AGENCY
Lake & McHenry Counties

Stickers | Safety | Watershed Planning | Contact

Watershed Newsletter

Next Watershed Education Meeting – is Thursday, March 16th @ 7:00PM – FWA Headquarters &
Zoom TOPIC: Excess Nutrients – AGENDA

Register HERE

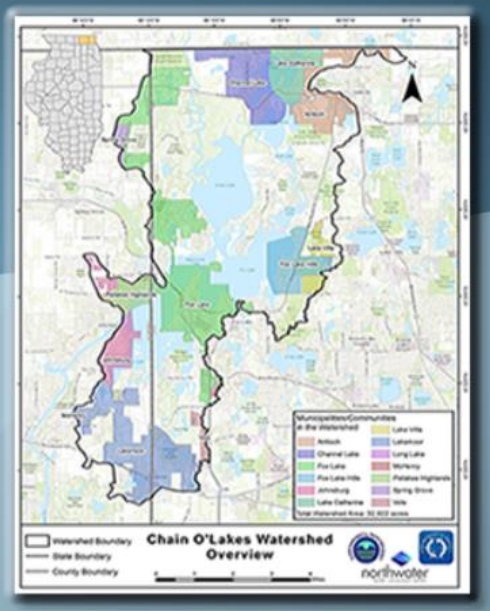
VOLUNTEER
Become A Watershed Volunteer

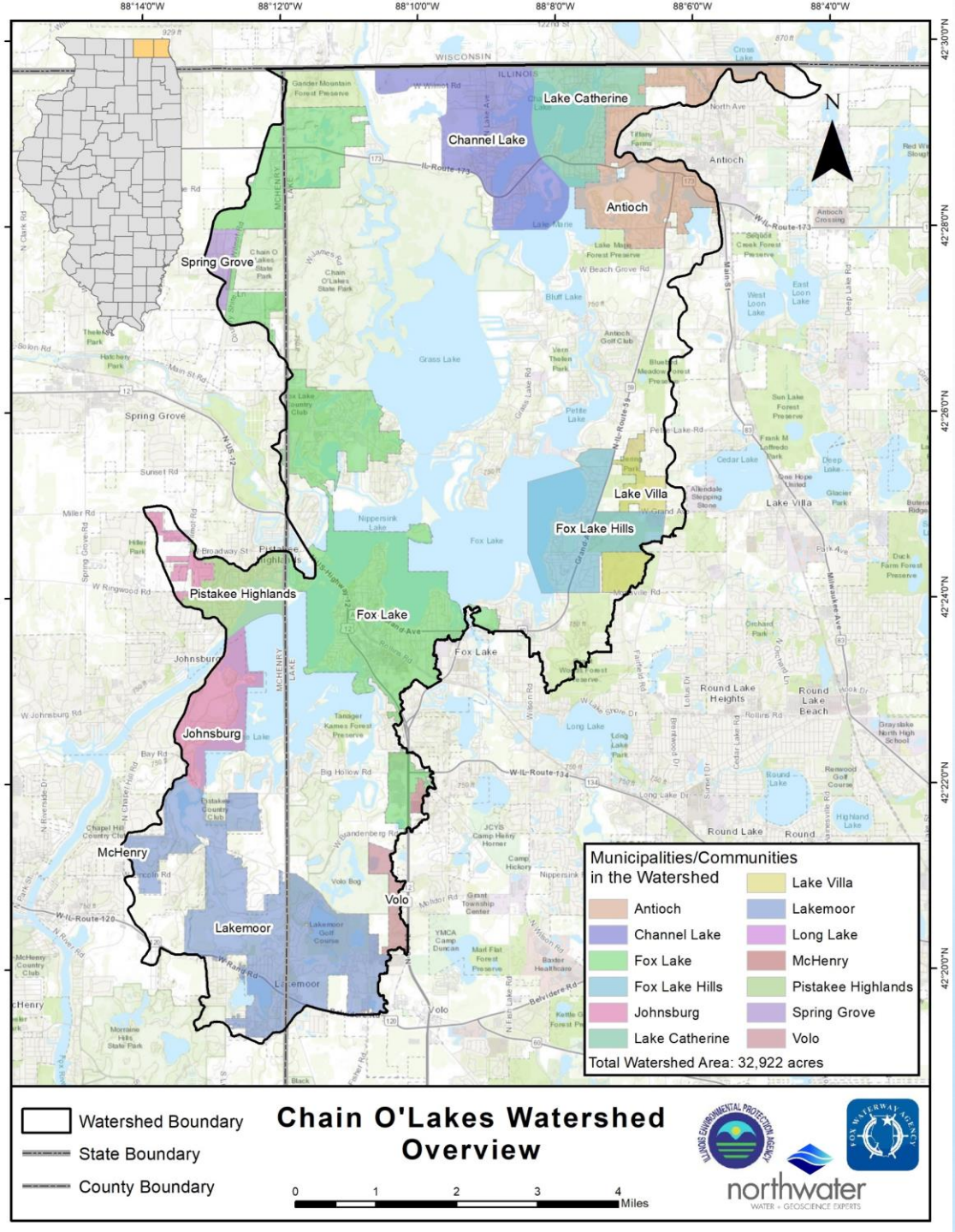
SUBMIT
A Watershed Concern

SUBSCRIBE
For Watershed Updates

FOX WATERWAY AGENCY
WATERSHED
Fox River / Chain O' Lakes

Welcome!





MORE TO COME

- PLAN STILL VERY MUCH IN PROGRESS
- MODELING
- PRIORITIZATION

- IMPLEMENTATION

MORE INFORMATION

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